Mobile e-commerce: Study and Model generation, Implementation issues and Analysis

A THESIS SUBMITTED
TO
SAURASHTRA UNIVERSITY, RAJKOT

FOR THE AWARD OF
DOCTOR OF PHILOSOPHY IN COMPUTER SCIENCE
IN THE FACULTY OF SCIENCE

SUBMITTED BY

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April 2006

CERTIFICATE

I hereby certify that **Mr. Radadiya Bankimchandra Laxmanbhai** has completed his thesis for doctorate degree entitled "**Mobile e-commerce: Study and Model generation, Implementation issues and Analysis**". I further certify that the research work done by him is of his own and original and is carried out under my guidance and supervision. For the thesis that he is submitting, he has not been conferred any degree, diploma or distinction by either the Saurashtra University or any other University according to best of my knowledge.

Place: Rajkot
Date:

Dr. N.N. Jani
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Department of Computer Science
Saurashtra University, Rajkot.

CERTIFICATE

I certify that the developed model for Mobile e-commerce and results derived by analysis and described in the thesis has been based on the literature survey, bibliographical references and through study of the web sites in respect of related areas.

Apart from these, all the analysis, hypothesis, inferences and interpretation of data and strategy have been my own and original creation. The model has been prototyped to a domain, which is my own and original creation. Moreover, I declare that the work done in the thesis, either the Saurashtra University or any other university has not conferred any degree, diploma or distinction on me before.

Place: Rajkot
Date:

Radadiya Bankimchandra Laxmanbhai

To my father, my mother, my sister and my wife

PREFACE

The Basis for acquiring knowledge is what I learnt in my Ph. D. tenure is not an end, but is always a kind of new beginning in the field of learning. It seems to be a new opening where I can prove my self.

A fact that was very apparent through out my Ph. D. tenure was that always there is wide discrepancy between what is taught in the theory and what actually happens in the reality. It is humbly submitted that information gives heat while knowledge gives light.

During model development of research, I have worked with stock trading Peoples who learnt me a lot of things. Along with the technical things I have also learnt how actually business process functions and how the people working in this type of work by interacting with verity of Internet Applications.

Radadiya Bankimchandra Laxmanbhai
Rajkot.

ACKNOWLEDGEMENT

I express my profound sense of gratitude to Dr. N.N. Jani - my research guide, who provides me undeviating encouragement, indefatigable guidance and valuable suggestions throughout the research project.

I take opportunity to express my deep sense of gratitude to Dr. K. P. Joshipura, Vice-Chancellor of the Saurashtra University for his consistent encouragement to the research and development.

I express my gratitude to all those officials in Computer Centre of Saurashtra University, who spared their precious time to me and thus provided me valuable information and insight into various important issues related to the study.

I also give my sincere thanks to faculty members and of Department of Computer Science, Saurashtra University, who debated few key issues and offered critical comments on several aspect of the study. I am also thankful to the administrative staff of the department, who has always been a support of inspiration during my entire work.

My deepest thanks to the reviewer of my thesis. I am highly indebted to my parents, my wife and sister, all my relatives and friends who constantly inspired me.

Radadiya Bankimchandra Laxmanbhai
Rajkot.

Selection of Research

This research has a number of aims which is to determine whether or not there is an opportunity for a sustainable international market for mobile commerce, in terms of information delivery, services, security and technical capability. Secondly, it examines how this opportunity can be implemented at the infrastructure needs of service provider of wireless and WWW backbone, banks and merchants as well as the application and technological support. This research aims at designing a theoretical framework and application model and case study system to assess the evolution and the progress path ahead of m-commerce, the role of emerging technology such as ad hoc networks and the business models of the different stakeholders.

The effectiveness of the system can be maintained if the concurrent information is delivered at the client ends. This helps the system as well as client from bottlenecks of unnecessary data interchange. For that purpose this research involves push technology support available in wireless technology. This research involves profile management and location based service to generate the valuable information and SMS and WAP Push services to deliver generated information at client end effectively.

Survey of the Area

You're driving along, and there's a McDonald's on the next block. Your cell phone beeps, sending you a message about a special on Big Macs. You push a button on the phone to place your order and buzz past the drive-through; an electronic transponder on your windshield records the sale. You grab your burger at the window and leave—and you didn't even have to dig around in your seat cushions for loose change. Later, you receive a monthly statement that shows all your burger (and other) e-transactions. This scenario is not so far-fetched. In fact, McDonald's is testing a system in southern California where customers can use the same transponders that pay highway tolls to pay for burgers and fries. The pervasive devices with inbuilt technologies and barrier service are ready to serve for such services with appropriate business model.

A systematic study of the industries has been made to explore which industries are in justified need of the m-commerce system for improving the effectiveness of their baseness operations. The modeled system is expected to be suitable for the industries whose need is information interchange - any where any time, fast alerts in terms of information, and secured transaction data delivery in wireless backbone. As the trading and the barter system falls under the stated category, m-trade has been chosen as m-commerce business model.

Trading is the business system which needs information alerts in fraction of time to take fast decision at any where, any time. The push content will make key role in this system to help user for receiving desired information.

LIST OF FIGURES

"M-commerce: Study and Model generation, Implementation issues and Analysis"

Content

1.1. Internet Technology

During the past two decades, the world has witnessed a technological evolution that has provided a totally new medium of communications entirely new to mankind. Through the use of networks, information in all forms has been disseminated throughout the world. What is known today as the World Wide Web (WWW) grew out of a project that began with a different intent (ARPANET). The ARPANET was designed and developed in 1969 by Bolt, Beranek and Newman under a contract for the Advanced Research Project Agency (ARPA) of the U.S. Department of Defense. The purpose of the Network was to study how researchers could share data, and how communications could be maintained in the event of a nuclear attack. The ARPANET Project was eventually turned over to the National Science Foundation (NSF) and ultimately became known as "Internet" which the NSF allowed access to businesses, universities and individuals. In the beginning, many resources such as Electronic Mail, News, Telnet, FTP, and Gopher were offered through Internet to its users.

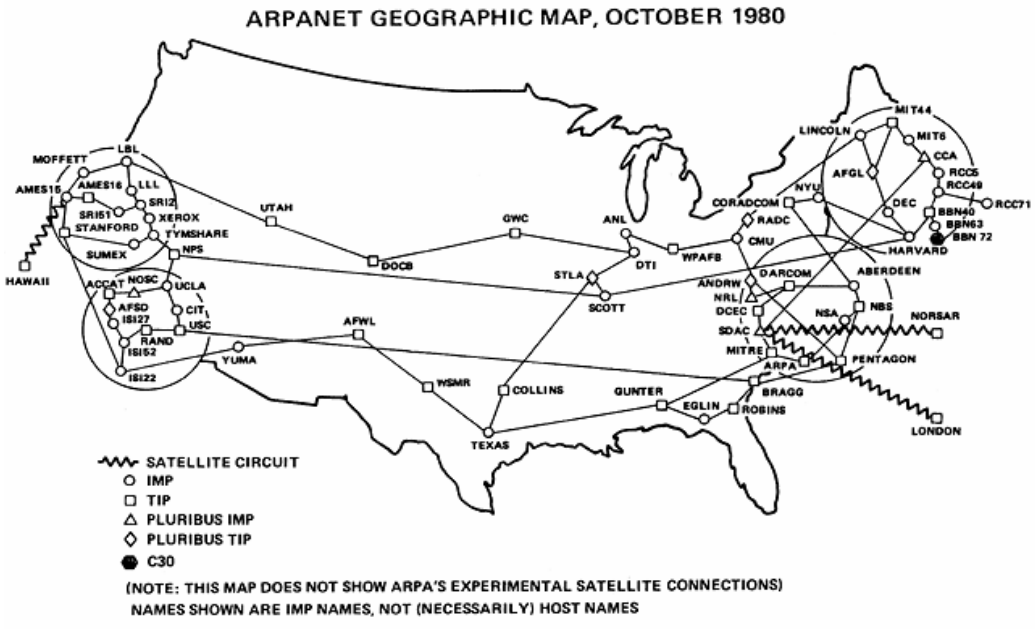


Fig. 1.1 ARPANET MAP, October 1980

One of the early applications of the Internet was its most popular application, the World Wide Web (WWW) or sometime known as "The Web". The WWW is one of the software tools that through the use of hypertext allow computers to link information in new ways different from a sequential reading approach, to make it easy to retrieve and add information from different computer sources through the use of communication links. In short time since its inception, the Internet has indeed revolutionized business, in that it redefines the methods used in traditional business practices and offers another important channel for mass communication. During early days of the Internet, the technology was primarily utilized as a medium of communication (e.g. e-mail) purposes. Soon, many organizations from both public and private sectors began to discover that in addition to use of the Internet and its popular WWW, they could utilize this technology in support of marketing and information dissemination purposes. This resulted in companies realized that the greatest payback in investing in the technologies of WWW would be in sharing information about the firm's products and services to the firms' stakeholders. As a result, successful organizations of all sizes and types have been adopting different applications/technologies of WWW in discovering emerging ways of doing business that even a decade ago could not be imagined. In recent years, the WWW has become the glittering palace of information and electronic trading. The Web has provided many improvements in the marketing business sector particularly in areas such as "identification of sales prospects", "immediate access to information (i.e. product/ service specifications and pricing) and allowing customers to obtain goods regardless of their geographical locations around the world. As soon as internet technologies grow the bundled services were assessed through it, like.

- Mail Technologies

- Electronic Data Interchange
- Electronic Commerce
- On-Line Analytical Processing (OLAP)
- Instant Messaging
- FTP
- Telnet
- Teleconferencing
- Video conferencing

The Popularity Growth of internet is extremely high.

- 1977: 111 hosts on Internet
- 1981: 213 hosts
- 1983: 562 hosts
- 1984: 1,000 hosts
- 1986: 5,000 hosts
- 1987: 10,000 hosts
- 1989: 100,000 hosts
- 1992: 1,000,000 hosts
- 2001: 150 – 175 million hosts
- 2002: over 200 million hosts
- By 2010, about 80% of the planet is expected to be on the Internet

The growth shows that the e-commerce is the major factor to make popularity of the internet. Dot-com domain name is allocated to the domains that are providing business services on the internet. And dot-com buzzword is applied to E-Commerce.

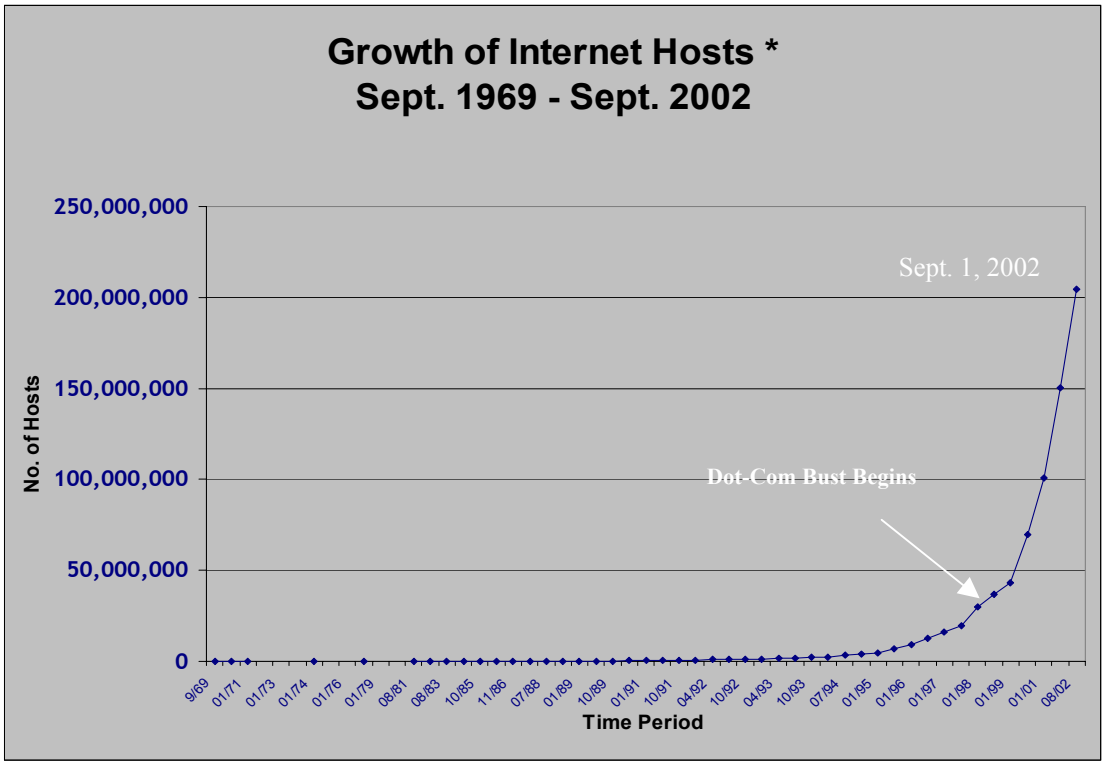


Fig. 1.2 Growth of internet

Business organizations are in need of globalization to expand the business with world wide community. Internet technologies play greater role in this fulfillment. They used internet technology to service the business information in form of Hypertext Documents through Internet Technologies. E-commerce is the paradigm which makes possible business transitions in this Internet backbone. Banking sectors and Payment gateways are taking care of the secured business transactions in E-commerce as Internet Technology involved secure data interchange in the internet backbone. Multimedia rich content make better presentation of the goods and services in the internet backbone. The internet technology has changed the business process faster and more effective through e-commerce thus many industries accept it to expand the business in front of world wide community.

1.2 e-commerce: new Business Era

In the emerging global economy, E-commerce and E-business are increasingly becoming a necessary component of business strategy and a strong catalyst for economic development. The integration of information and communications technology in business has revolutionized relationships within organizations and those between and among organizations and individuals. Specifically, the use of ICT (Information and Communication Technology) in business has enhanced productivity, encouraged greater customer participation, and enabled mass customization, besides reducing costs. With developments in the Internet and Web-based technologies, distinctions between traditional markets and the global electronic marketplace such as business capital size, among others-are gradually being narrowed down. E-commerce coupled with the appropriate strategy and policy approach enables small and medium scale enterprises to compete with large and capital-rich businesses.

1.2.1 E-commerce: An overview

Electronic commerce or E-commerce refers to a wide range of online business activities for products and services. It is also known as "Any form of business transaction in which the parties interact electronically rather than by physical exchanges or direct physical contact". E-commerce is usually associated with buying and selling over the Internet, or conducting any transaction involving the transfer of ownership or rights to use of goods or services through a computer-mediated network. Though popular, this definition is not comprehensive enough to capture recent developments in this new and revolutionary business phenomenon. A more complete definition is: E-commerce is the use of electronic communications and digital information processing technology in business

transactions to create, transform, and redefine relationships for value creation between or among organizations, and between organizations and individuals. In E-commerce, information and communications technology is used in inter-business or inter-organizational transactions (transactions between and among firms/organizations) and in business-to-consumer transactions.

In E-business, on the other hand, Information and Communication Technology is used to enhance one's business. It includes any process that a business organization (either a for-profit, governmental or non-profit entity) conducts over a computer-mediated network. A more comprehensive definition of E-business is: "The transformation of an organization's processes to deliver additional customer value through the application of technologies, philosophies and computing paradigm of the new economy."

Three primary processes are enhanced in E-business:

1. Production processes, which includes procurement, ordering and replenishment of stocks, processing of payments, electronic links with suppliers, and production control processes, among others.
2. Customer-focused processes, which include promotional and marketing efforts, selling over the Internet, processing of customers purchase orders and payments and customer support, among others.
3. Internal management processes, which includes employee services, training, internal information-sharing, video-conferencing, and recruiting. Electronic applications enhance information flow between production and sales forces to improve sales force productivity. Workgroup communications and electronic publishing of internal business information are likewise made more efficient.

1.2.2 Different types of e-commerce

The major different types of E-commerce are:

- Business to Business (B2B)
- Business to Consumer (B2C)
- Business to Government (B2G)
- Consumer to Consumer (C2C)
- Mobile commerce (M-commerce).

B2B E-commerce: B2B E-commerce is simply defined as e-commerce between companies. This is the type of e-commerce that deals with relationships between and among businesses. About 80% of e-commerce is of this type, and most experts predict that B2B E-commerce will continue to grow faster than the B2C segment.

The B2B market has two primary components: e-infrastructure and e-markets. e-infrastructure is the architecture of B2B, primarily consisting of the following:

- Logistics - transportation, warehousing and distribution.
- Application service providers - deployment, hosting and management of packaged software from a central facility.
- Outsourcing of functions in the process of e-commerce, such as Web-hosting, security and customer care solutions.
- Auction solutions software for the operation and maintenance of real-time auctions in the Internet.
- Content management software for the facilitation of Web site content management and delivery.
- Web-based commerce enablers.

E-markets are simply defined as Web sites where buyers and sellers interact with each other and conduct transactions.

Most B2B applications are in the areas of supplier management (especially purchase order processing), inventory management (i.e.,

managing order-ship-bill cycles), distribution management (especially in the transmission of shipping documents), channel management (i.e., information dissemination on changes in operational conditions), and payment management (e.g., electronic payment systems).

B2C E-commerce: B2C E-commerce, or Commerce between companies and consumers, involves customers gathering information; purchasing physical goods or information goods and for information goods, receiving products over an electronic network. It is the second largest and the earliest form of E-commerce.

B2C ordinarily refer to on-line trading and auctions, for example, on-line stock trading markets, on-line auction for computers and other goods. B2C e-commerce refers to the emerging commerce model where businesses /companies and consumers interact electronically or digitally in some way. One of the best examples of B2C E-commerce is Amazon.com (http://www.amazone.com), an online bookstore that launched its site in 1995.

In a B2C e-commerce the focus is more about enticing prospects and converting them into customers, retaining them and share value created during the process. The ultimate goal is the conversion of shoppers into buyers as aggressively and consistently as possible. Flow includes product orders/service requests from customers, product information, specifications, providing of services by Business etc. In addition, it may also include, flow of tangibles (e.g. goods ordered from customer, documents transfers between business and customer etc.)

Types of services typically covered under B2C e-commerce:

- Auction stores (e.g.ebay.com)
- Online stores (e.g. amazon.com)

- Online services (e.g. www.travelocity.com)

B2G e-commerce: Business to government E-commerce or B2G is generally defined as commerce between companies and the public sector. It refers to the use of the Internet for public procurement, licensing procedures and other government related operations. This kind of E-commerce has two features: first, the public sector assumes a pilot/leading role in establishing E-commerce; and second, it is assumed that the public sector has the greatest need for making its procurement system more effective. Some time B2G e-commerce is know as e-governance. Web-based purchasing policies increase the transparency of the procurement process. To date, however, the size of the B2G ecommerce market as a component of total e-commerce is insignificant, as government e-procurement systems remain undeveloped.

C2C e-commerce: Consumer to consumer E-commerce or C2C is simply commerce between private individuals or consumers. This type of E-commerce is characterized by the growth of electronic marketplaces and online auctions, particularly in vertical industries where firms/businesses can bid for what they want from among multiple suppliers. It perhaps has the greatest potential for developing new markets.

This type of E-commerce comes in at least three forms:

- Auctions facilitated at a portal, such as eBay (http://www.ebay.com) which allows online real-time bidding on items being sold in the Web.
- peer-to-peer systems, such as the Napster model (a protocol for sharing files between users used by chat forums similar to IRC) and other file exchange and later money exchange models.

- Classified ads at portal sites such as Excite Classifieds and eWanted (an interactive, online marketplace where Buyers and Sellers can negotiate and which features "Buyer Leads & Want Ads").

There is little information on the relative size of global C2C E-commerce. However, C2C figures of popular C2C sites such as eBay and Napster indicate that this market is quite large. These sites produce millions of dollars in sales every day.

1.2.3 Enterprise E-commerce Applications study

Auctions Applications

"Electronic auctions (on the Internet) offer an electronic implementation of the bidding mechanism also known from traditional auctions. This can be accompanied by multimedia presentation of the goods. Usually they are not restricted to this single function. They may also offer integration of the bidding process with contracting, payments and delivery. The sources of income for the auction provider are in selling the technology platform, in transactions of a collection of e-shops, usually enhanced by a common umbrella, for example of a well-known brand. It might be enriched by a common guaranteed payment method.

Advantages of Internet auctions

- Convenience: It gives the participants convenience as bidder can stay at his home or office and still participate in the bidding just as in traditional auctions. In addition, it is also more convenient for a bidder to find more about the goods being auctioned.

- Flexibility: Traditional auctions allow only synchronous bidding requiring all bidders to participate at the same time. In contrast, Internet auctions allow asynchronous bidding lasting days or weeks, which offers more flexibility to the bidders.
- Increased reach: The potential of reach of an Internet based auction site is global and thus the market for auctioned good is very large.
- Economical to operate: These are cheaper to run as lot of costs relating to infrastructure required for a conventional auction system is not necessary for this.

Disadvantages of Internet auctions

- Inspection of goods: In an Internet based auction, it is not possible to physically inspect the goods. The bidders have to rely on the information provided or sometimes, may have to rely on some electronic images of the goods on auction.

- Potential for fraud: Internet bidder has to trust that the seller would actually send the good for which he paid. Also typically payments are made by providing credit card details through the Internet, which may also not be always safe.

Application of Online Stores

It refers to marketing of a company's products through the web. It may be done either to promote the company, its products and services or to actually sell the products/services through this virtual store. One of the best examples of an e-store is Amazon.com, which started selling books online and gradually extended to other product categories.

Benefits for the company

- Increased demand
- A low-cost route to global reach
- Cost-reduction of promotion and sales.
- Reduced costs

Benefits for the customers

- Lower prices
- Wider choice
- Better information
- Convenience

Shopping through the online stores is gaining popularity and acceptance. Although majority of the revenue is in the B2B sales, B2C sales are also expected to improve in the coming years. However, for this to occur, online stores need to deliver far more value to the customers and at the same time find new ways to generate revenues. Delivering value to customers: In order to develop more value to the customers, the following may be considered.

- Merchants have to try to find ways to gain competitive advantage in factors other than just the price.
- Online shops need to provide a shopping-experience that addresses all of the customer's requirements. It should also try to provide an environment that is easy to explore.
- Expansion of the range of services
- Find cost-effective ways to increase customer base and generate higher revenues
- Effective presentations of product using multimedia involvement.
- Customer support Center or Help Desk

New ways to generate revenues: One of the key problems which the online stores face is the lack of a good and effective revenue model. Online stores therefore have to explore new ways to generate revenues (e.g. collect membership fees from customers).

Applications for Online Services

This is another area where companies can exploit Internet. Many companies are using Internet to provide customer service. In service sector banking and stock trading is one such examples. Companies like eTrade.com (http://www.etrade.com) have brought the ease of trading stocks to customer's PC. Another interesting example is Makethemove.com (http://www.makethemove.com).

Mike McCabe founded MaketheMove.com in 1998. Its mission is to simplify the lives of Internet users by creating functional, interactive services that will make their lives easier and better. They provide secure, Internet-based electronic commerce solutions for the business-to-consumer market. MaketheMove.com offers individuals the opportunity to set-up, transfer and cancel utilities such as gas, electric and local phone and services such as long distance and wireless telephone, cable television, Internet service providers, paging, newspapers, magazines, and more when customers shift from one location to another.

www.ussearch.com, www.Records.com, www.whowhere.com are the service provides who are providing the service on the internet for classified information of person, property, court records, criminal background etc. are taking either membership charges or records fee to retrieve the information.

Online Gambling Application

www.winneronline.com, www.gonegambling.com, www.sports.com, www.gambling.com and other are website running the application where consumer comes together and play gambling either on the form of game or with bid. These applications are taking funds from consumers and converts in to some points. The consumer then allocates it to any game or bid on any running event. On, completion of game or event few of them are winner and the points of such users are increased. Consumers can convert their points in the amount and withdrawal in his preferred payment mode.

Consumer saves time with such applications without reaching at the spots where physical gambling took place. As well as the gambling process is transparent for the user. The service provide benefited through getting large number of users from world wide community.

1.2.4 e-payment and e-banking

An electronic payment system (EPS) is a system of financial exchange between buyers and sellers in the online environment that is facilitated by a digital financial instrument (such as encrypted credit card numbers, electronic checks, or digital cash) backed by a bank, an intermediary, or by legal tender. EPS plays an important role in E-commerce because it closes the E-commerce loop. In developing countries, the underdeveloped electronic payments system is a serious impediment to the growth of E-commerce. In these countries, entrepreneurs are not able to accept credit card payments over the Internet due to legal and business concerns. The primary issue is transaction security. The absence or inadequacy of legal infrastructures governing the operation of e-payments is also a

concern. Hence, banks with e-banking operations employ service agreements between themselves and their clients.

The relatively undeveloped credit card industry in many developing countries is also a barrier to E-commerce. Only a small segment of the population can buy goods and services over the Internet due to the small credit card market base. There is also the problem of the requirement of "explicit consent" (i.e., a signature) by a card owner before a transaction is considered as avalid requirement that does not exist in the U.S. and in other developed countries.

What is the confidence level of consumers in the use of an EPS?
Many developing countries are still cash-based economies. Cash is the preferred mode of payment not only on account of security but also because of anonymity, which is useful for tax evasion purposes or keeping secret what one's money is being spent on. For other countries, security concerns have a lot to do with a lack of a legal framework for adjudicating fraud and the uncertainty of the legal limit on the liability associated with a lost or stolen credit card.
In sum, among the relevant issues that need to be resolved with respect to EPS are: consumer protection from fraud through efficiency in record-keeping, transaction privacy and safety, competitive payment services to ensure equal access to all consumers, and the right to choice of institutions and payment methods. Legal frameworks in developing countries should also begin to recognize electronic transactions and payment schemes.

Many services providers are providing support of e-payment and known as payment gateway in e-commerce terminologies. Paypal, Authorized.net, e-gold, 2checkout are among favorite payment gateway.

e-banking

e-banking includes familiar and relatively mature electronically-based products in developing markets, such as telephone banking, credit cards, ATMs, and direct deposit. It also includes electronic bill payments and products mostly in the developing stage, including stored-value cards (e.g., smart cards/smart money) and Internet based stored value products. e-banking in developing countries is in the early stages of development. Most banking in developing countries is still done the conventional way. However, there is an increasing growth of online banking, indicating a promising future for online banking. Payment transfer in bank through internet is known as Wired Transfer in e-commerce terminology.

1.2.5 Information need is anywhere any time

Now a day user need information on the hand. In the e-commerce applications user need to move to desktop computer to get service, retrieve information or to perform the transactions. If user replace the wireless devices (mobile devices, palmtop, PDA) with desktop computer user may get information or services on the hand. As this kind of devices are too small so that user may care it in our pocket. And wireless devices are functional to communicate as well as to interchange the digital data. The terminology is know as mobile commerce or m-commerce

As content delivery over wireless devices becomes faster, more secure, and scalable, some believe that m-commerce will surpass wire line e-commerce as the method of choice for digital commerce transactions. This may well be true as mobile phone users are in large figure in comparison of Internet users.

Industries affected by m-commerce include:

- Financial services, including mobile banking (when customers use their handheld devices to access their accounts and pay their bills), as well as brokerage services (in which stock quotes can be displayed and trading conducted from the same handheld device)
- Telecommunications, in which service changes, bill payment and account reviews can all be conducted from the same handheld device
- Service/retail, as consumers are given the ability to place and pay for orders on-the-fly
- Information services, which include the delivery of entertainment, financial news, sports figures and traffic updates to a single mobile device.
- Even existing e-commerce service provider may took advantages through alerting the important user information in wireless devices in the from of alerts which help consumers to took fast decision.
- Government may implement their services on mobile devices through serving news of their policies.

1.3 Pervasive Computing

Pervasive computing still means different things to different people. For some, pervasive computing is about mobile or other wireless devices which can access internet services. For others, the emphasis is on "smart" or "active" spaces, context awareness, and the way people use devices to interact with the environment. And still others maintain a device-centric view, focusing on how best to deploy new functions on a device, exploiting its interface modalities for a specific task. Today, pervasive computing is more art than science. It will remain this way as long as people continue to view mobile computing devices as mini-desktops, applications as programs that run on these devices, and the environment as a virtual space that a user enters to perform a task and leaves when the task is finished.

1.3.1 Wireless or mobile computing Devices

When mobile device evolved the goal is for communication without wired line. The mobile devices taking supports of technology for the communication like GSM, CDMA, i-mode. As the technologies rapidly change more functionality is added in the mobile devices. Now a day the mobile devices are not only used for communications but lots of other features are possible.

Functions of new generation mobile devices

- TFT LCD color screen with high color resolutions which gives good performance in multimedia rich content.
- More processing Powers
- Large Memory capacity

- Data Storage through internal memory or external devices which may plug-in with mobile devices.
- Infrared for data interchange with other infrared devices
- Wi-fi for data interchange with other wireless devices
- Bluetooth for data interchange with other Bluetooth devices
- WAP for internet access
- GPRS barrier service support
- JAVA compatibility for accessing Java enable game and applications
- Operating system which provide interface between device and application

With these included features mobile device is mush similar as small computing node with, capabilities of internet access and also able to load small application.

1.3.2 Mobile Computing and mobile commerce Applications study

Fizz Traveller - Smartphone

Fizz Traveller 2, feature packed travel mate. Superb weather Microsoft mobile device. Over 58000 world locations, world times, alarms, daylight maps, itinerary trip help, currency conversions, general conversions, new graphics, themes, interface & home screen support. Localised in : EN,GR,FR,SP,IT,DU

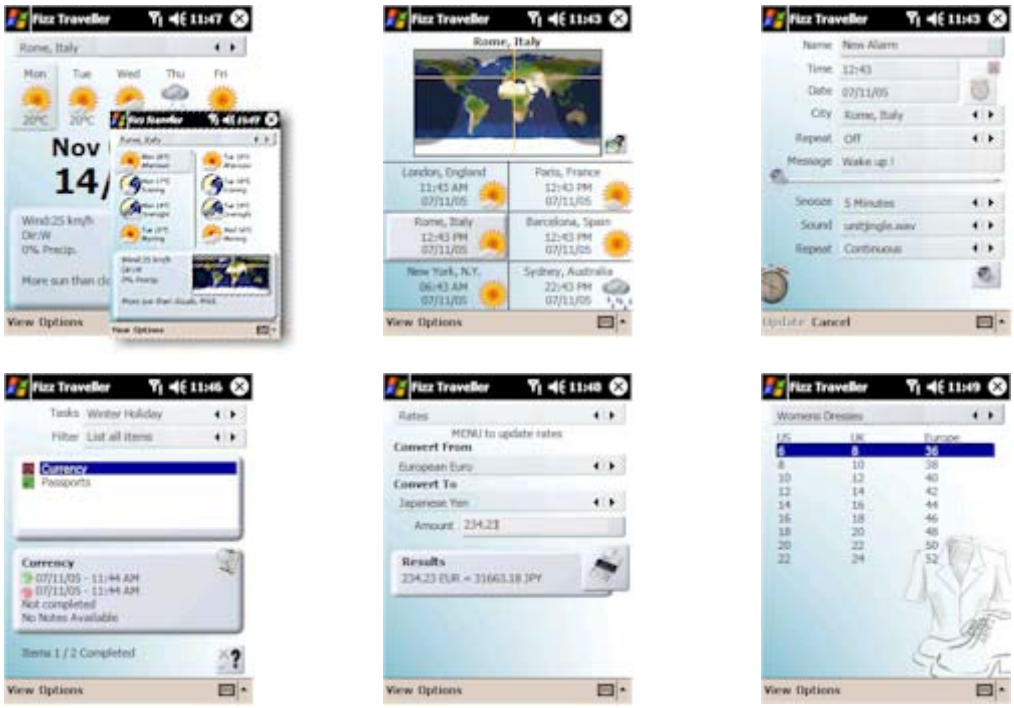


Fig. 1.3 Fizz Traveller – Smartphone Screenshots

- 6 Languages - English, French, German, Spanish, Italian & Dutch
- Weather forecasts for over 58000 global cities, maps & airport delays
- World times, alarms, currencies & much more - theme the interface

Vanguard Sales Manager

Vanguard is a field sales system for the Pocket PC. It is multi-user, and highly scalable. The user can maintain a database of customers, products and orders. Barcodes can be scanned, signatures can be captured, and invoices can be printed on site. Data can be synchronized with SQL Server and Microsoft Access databases.

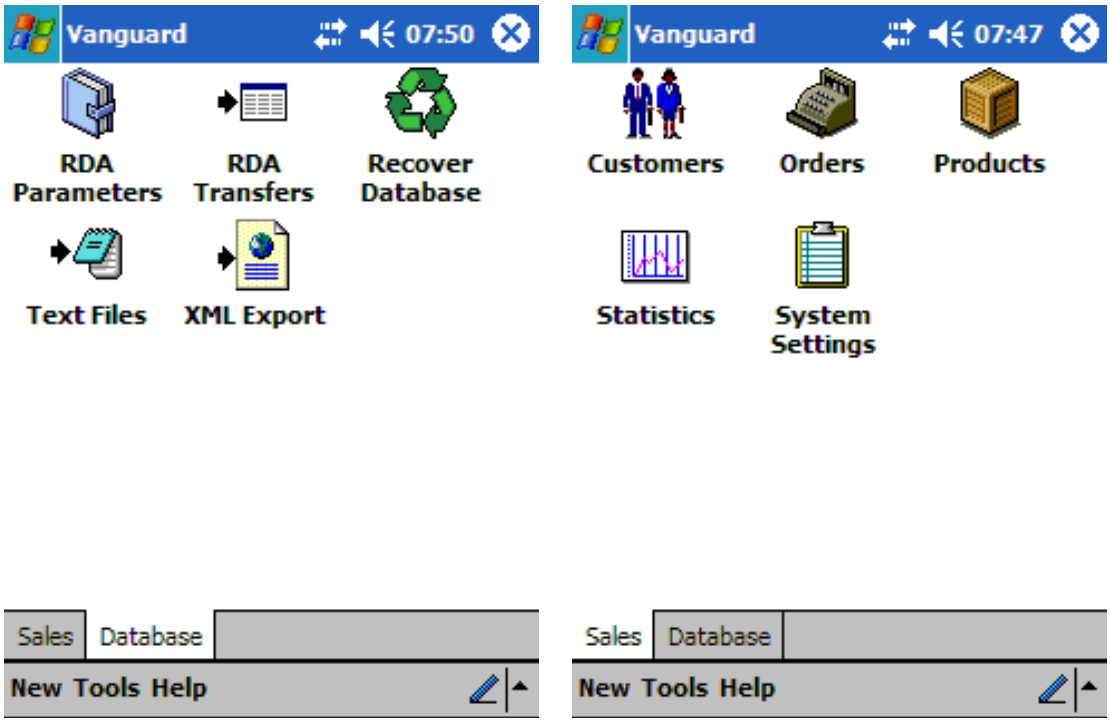


Fig. 1.4 Vanguard Sales Manager Screenshots

- Highly scalable SQL CE database
- Can run in a multi-user environment
- Synchronizes with SQL Server and Microsoft Access

MobiLearn Talking Phrasebook, Multilanguage

Choose a phrase in English, French, German, Italian or Spanish to see and hear an instant translation into any of the other four languages. Each phrase is spoken in a model native voice, recorded in high fidelity. Simply echo what is heard to express with confidence, even if without the need of keen knowledge of the Language.

Fig. 1.5 MobiLearn Talking Phrasebook, Multilanguage Screenshots

- Up to 2,000 key phrases in five languages, spoken in clear native voices
- Instantly shows and speaks the translation of any chosen word or phrase
- Tests knowledge flashcard-style and shows progress over time

Abidia Wireless for Smartphone

Enhance eBay and International eBay sites with effortless anytime any access wireless handheld devices and mobile phones; featuring customizable real-time synchronization with eBay accounts, wireless searching, cached browsing, wireless bidding, and the ability to effortlessly manage auction listings on-the-go.

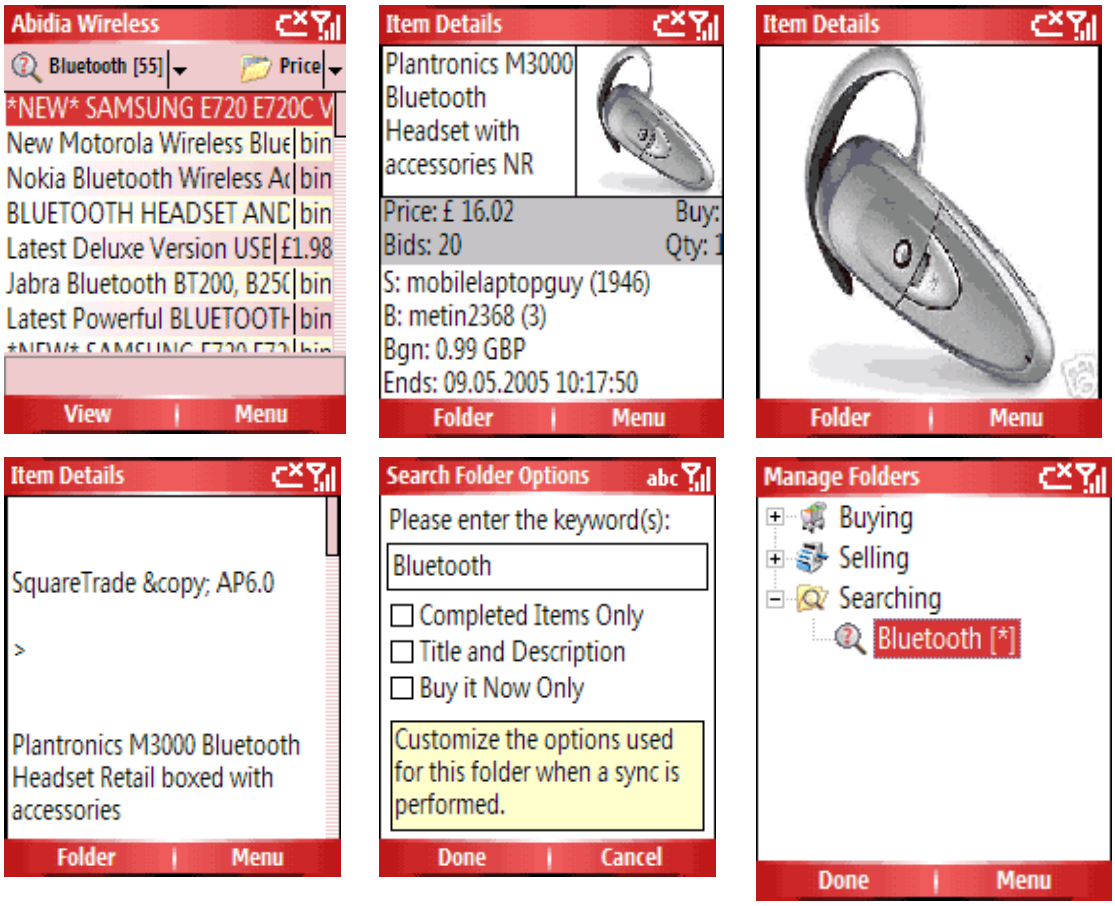


Fig. 1.6 Abidia Wireless for Smartphone Screenshots

- Completed Auction Searching, Quick Start Wizards, On Device Registration
- Full screen and thumbnail images, Auction Item Listings
- Easy to use, simple navigation hardware buttons, Simplified Folder Interface

Mobile Messenger

Yahoo, MSN other company are providing Mobile messenger applications which will get connected to in chat with friends.

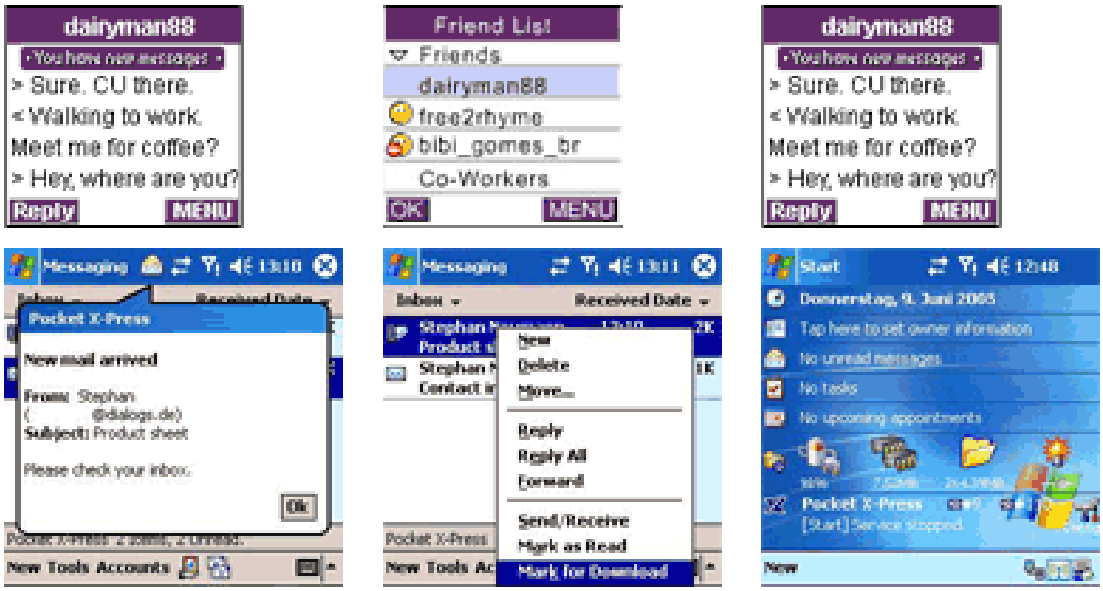


Fig. 1.7 Mobile Messenger Screenshots

Mobile Mail

AOL, MSN, Yahoo and other portal are providing their mail client which will access mail account from mobile device or palm device. User can even right short message and other mail utility. Even, they provide the mail portal which will be accessible through mobile micro browser.

Wireless Emergency Services Application

Wireless Emergency Services (WES) refers to the use of mobile positioning technology to pinpoint mobile users for purposes of providing enhanced wireless emergency dispatch services (including fire, ambulance, and police) to mobile phone users. While WES is a type of location-based service (LBS), it is a mandate in the United

States where 911 is the official dialing pattern for fixed and mobile network access to emergency services.
In order to deploy WES in the US, mobile operators need the following:

- PDE
- Wireless 911 application
- Location manager middle-ware application
- Coordination with PSAPs regarding locations/routing to emergency service jurisdictions

To take advantages of this service user need GPS supportive mobile or palm device.

Mobile Banking

Now a day provide banking provides mobile alerts on the mobile devices when the fund withdrawal or deposited in their accounts. Alerts are in the form of Short Message Service (SMS).

Horserace Gambling (Scaraboo.com)

This application is running as a portal and facilities user to play their bid from their mobile or palm device. User can choose their bat and select their horse. The site will show the video clips of previous recorded videos of horse. User can check their account status of bit. And on the completion of game user will get alerts of win or loss.

Fig. 1.8 Horserace Gambling (Scaraboo.com) Screenshots

AirTrader Stock Application

AirTrader is an Internet based, order entry and account management system. It has all the features and functionality of a professional's trading system, enabling users to place, change, cancel, and monitor orders for equities, options and mutual funds. It tracks positions, balances, order status and trade history. It also gives users access to real-time quotes and quote lists. AirTrader also accommodates mobile users connecting through personal digital assistants (such as the Palm VII and the PocketPC) as well as WAP-enabled cell phones

Western Railway Train Status Application

Fig. 1.9 Western Railway Train Status Application Screenshots

This application is running as a portal on rediff.com which provides service to check the western railway status. It allow user to search train by train name or train number and shows the status information like Station Passed, Status (early, on time or late), Schedule time and Actual time.

Entertainment and Gaming Portal

This kind of portals are providing the Wallpapers, ring tone, logos, videos, applications and tools, games to be downloaded in the mobile devices. Here the product is in form of digital content which is of fewer prices. Such, portal are accepting micro payments for these type of contents which is embed with mobile service provider. The charges are added in the mobile bill in case of post paid customer or debited from user's available balance if user is prepaid customer.

Value added services

Value added services are application which comes in mobile menu. It is service provider entity which serves either mobile content (ring tone, wallpaper, logo, picture, video, etc.) or information (news, business updates, sports news and many more). The application sends SMS with service related keywords to the application which located at service provider's SMS server. The application parse the service type with received keywords and send the response back to the user. The response is in the form of demanded mobile content or requested information. Service provider are taking charges for each generated request from user by adding charges in the mobile bill in case of post paid customer or deducting from user's available balance if user is prepaid customer.

1.3.3 Interface of mobile computing Applications

Though the mobile devices are able to serve the information through application or internet it has certain limitation which need to taken during development of application on this medium.

Processing Power: The desktop computer uses microprocessor for processing and able to perform multi process and multi threading

application. Mobile device is totally different architecture. Processing role is performed by micro controller in mobile device. So, application needs to take care of processing load.

Memory and storage: This is a lot more constrained than on a PC, because handset manufacturers are cost-sensitive, and thus reluctant to add any additional components unless it is really necessary. Also some mobile devices do not have a persistent storage of their own but in comparison of desktop commuter it is so much less. And memory dumping is also not possible in mobile devices.

Power Management: Mobile devices are battery powered, and the need to have the device available for long periods of time means that the processing CPU cannot make significant demands on the battery.

Display: Now a day mobile device is available with color LCD and TFT screen and the color resolution is significant with the screen size. But, as the mobile device screen is small in size. It needs to take care that application output must fit within screen.

Input: Mobile devices typically do not have keyboards, or if they do they are limited in size. Therefore, input is more challenging than on a typical PC. During application developments few care need to taken like less data inputs and provide a selection methods with possible input values. If in case of necessary input application from user it only accept input value in preferred formats. Like string inputs, numeric inputs, inputs length and etc.

Internet Application: when user is surfing the information through mobile device the request and response take long time to travel in the internet backbone as well as service provider networks.

So, it is preferable that full information set retrieve in the page and separated through card. Then user may navigate with in card only. The page is loaded in the mobile device memory so in the case of navigation from one card to another request will not passed in the network again and the information will appear fast from mobile cash information.

The mobile internet bandwidth is low in comparison of wired desktop internet so application needs to take care the multimedia data like image, audio and video data use compression formats. Now, a day many compression formats and their compatible encoder available which converts the multimedia content is respective compression formats and than compatible software may assess such content.

Devise independency: Different screen size and color resolution and different micro browser may cause problem while accessing application. So, it is suggested that application need to test in different environment to make it fit with all possible device. The vendors of the mobile devices are also publishing free development kits and simulators so that developer may test the application result through it without making any extra development cost.

Active Information: The application needs to design in such manner so that it will identify the user and serve the information which is really what user looking for. To manage the active information application to manage user need in the form of user profile which will take a good role in serving the information. Like, if any user is visiting online shopping site the application maintain the user previous activity and when the user come back it will show the similar product match with user interest. Stock application serves the price information of the scripts where user is interested to trade.

This will reduce surfing time of user and also reduce the network traffic.

1.4 Mobile Commerce implementation

E-commerce applications are serving through internet backbone to computing nodes. The e-commerce technology can not fulfill significant demand of any where ay time information business. It only capable to serve information to wired networks which are connected with internet backbone. Now, a day wireless communication device (like, mobile, palmtop and PDA) are cost affective and the bundle features make commutability for data interchange in internet backbone with its basic communication purpose. Mobile commerce are ready to serve the business service on wireless communication medium. Research took study of its implementation issues.

1.4.1 Audience Availability

First implementation issue of mobile commerce is audience availability who is accepting the business services through mobile devices. The research collected the figures of mobile users and awareness of mobile commerce from different area of world. Much of the early availability and take-up of m-commerce services has been within Europe and Asia and has occurred during the past 18 months. The dollar value of global m-commerce activity is forecast to reach US$37 billion by 2007 10, up from US$6.7 billion in 2002. International reports have provided some overwhelming estimates of the predicted size and worth of the m-commerce market. This prediction is converting in the fact after seeing the current situations.

Europe: In Europe, where penetration levels for mobile phones have reached 60 percent, it is estimated that 30 percent of the adult population will be mobile Internet users. The market for m-commerce in Europe alone is estimated to be worth 23 billion euros. One of the key drivers of this growth is the significant uptake of wireless devices, including mobile phones and more advanced technologies such as PDAs. These are continuing to be developed with wireless computers linked with a mobile phone emerging in the consumer market. Revenues to mobile telephone companies and content providers from telephone handset screen logos and ring tones alone generated US$2.9 billion in Western Europe in 2002. 3G services in several European markets are beginning to sign up customers.

United Kingdom: There is little awareness of more advanced m-commerce services to date in the United Kingdom. In 2002, 85 percent of Internet users said they had no intention of ever using a mobile phone to access the Internet and most find the idea of emailing, banking, or searching for information on a mobile wholly unappealing. This is likely to change as the technology develops. At May 2003, only 2 percent of UK mobile users are able to use MMS (Multimedia Messaging Service). However, people aged 15-34 spent US$95 million on ring tones, US$78 million on logos and US$142 million on SMS (Short Message Service) alerts in 2002.

Japan: Japan's I-mode service, released by NTT DoCoMo in February 1999, is one example of a success story for mobile Internet services. At February 2003, close to 80 percent of Japanese mobile telephone owners were subscribed to wireless Internet services, such as NTT DoCoMo's I-mode. With 1 million new subscribers joining each month, I-mode is now the largest Internet access platform in Japan. I-mode subscribers have access

to a number of m-commerce services. In addition to buying tickets, ordering books and getting the news delivered to a mobile handset, subscribers can carry out banking transactions with up to 280 banks and securities brokers. Several Japanese carriers have already launched 3G services.

Singapore: The value of m-commerce in Singapore has been predicted to reach US$403 million by 2005. Young people in the Asia-Pacific region currently spend almost 14 percent of their total leisure spending on mobile products. Singapore Telecommunications (SingTel) launched a corporate text messaging platform for promoters and advertisers in 2002. BizLive SMS had signed up 100 customers to its permission based SMS marketing service at June 2003.

United States: The US is lagging behind Europe due to an earlier lack of a standard for mobile phone network technology. SMS is only now becoming popular as carriers roll out new networks. However, the market is expected to develop rapidly once m-commerce takes off in Europe. It is expected that the number of Internet-enabled mobile devices will exceed the number of PCs by the end of 2003. Another research centre, the Yankee Group, similarly predicts that by 2004, more than 30 per cent of all wireless Users will access the Internet through mobile devices.

India: In India the figures shows that the large number of mobile user added in last few years. The effective rate of mobile devices and mobile subscription charges increase the mobile users. The mobile users are in large amount in comparison of computing nodes (desktop PC). The mobile internet usages are not as much popular in comparison of other countries. But the major growth found in

mobile internet user in few years. And people are ready start adopting mobile business services on their mobile devices.

Australia: Australia's mobile telecommunications industry has performed strongly over the last 10 years, making a substantial contribution to the wider telecommunications industry and the Australian economy. There are an estimated 14 million mobile phones in use by 65 percent of the Australian population in over 50 percent of households. Australia's mobile penetration rate ranks Australia fourth in terms of market development in the Asia-Pacific region. Internationally, it is estimated that there are 1.3 billion mobile users.2 While growth has slowed in the last few years, even the lowest growth rate in 2001 was associated with a 10.6 per cent increase in subscriber numbers. The growth rate in mobile subscriber numbers between 2002 and 2003 was 13.5 per cent.

1.4.2 Cost (Infrastructure, Device)

Currently, most of the m-commerce services that are being rolled out use existing mobile technology, known as second-generation (2G) and 2.5G technologies. These technologies provide data connection speeds ranging from 9.6kbps (for GSM and CDMA – Code Division Multiple Access – technologies) up to 114kbps (GPRS – General Packet Radio Service). M-commerce services that are supported by these technologies are typically low value transactions such as the provision of information like news headlines or advertisements, playing games and making small purchases. Current 2G networks rely on SMS for these transactions to be completed. More advanced networks, for example 2.5G and 3G, could facilitate more advanced m-commerce services, including location-based services, Internet access, remote control of home networks and security systems and mobile banking.

Telstra launched Telstra Mobile Loop to consumers in March 2003. Mobile Loop is delivered on Telstra's upgraded CDMA network. Features include video messaging, email, mobile Internet access via WAP (Wireless Application Protocol), and video games. Customers are able to download applications to their handsets. Ring tones, screen logos and SMS are still the main fare, with picture messaging (an MMS application), games, email, chat, and news or entertainment alerts added to the menu. Optus has launched some services on its 2.5G GPRS network. Subscribers can access Internet search sites such as Google and news sites that have been customized for wireless users. Vodafone's live! Provides m-commerce services on GPRS networks. Subscribers can select from features such as picture messaging, games, ring tones, content and information services, and email. Hutchison launched its 3G service, 3, in April 2003. Hutchison's wideband-CDMA network has the technological capacity to offer the most advanced mobile services. Hutchison also launched 2.5G GPRS service for its customer. The vendors of wireless service provider has just extended their network infrastructure or established with generation mobile technologies. But it not make mush more cost in comparison of old generation mobile technology. And hence to access the service of such network customer need not to pay high charges.

In order for m-Commerce to gain a significant foothold there can be no added cost. That is to say, users will not pay for the privilege of using m-Commerce, if it is going to be adopted it has to be free or nearly free. Therefore, in time the wireless connection market will be driven to commodity, just like the internet access market has been. Vendors are going to have to pay the upfront capital costs themselves and hope to recoup the cost in the volume of traffic, and traffic will be there if the price is right.

To access the mobile commerce application from the mobile device user need 2G and GRPS barrier service support or higher generation device. And the device also need WAP support to access the internet information. The devices with such bundle technology support are expensive but it is not more expensive. Even the device with GPS support may take advantages of few applications which are serving the location based services.

1.4.3 Mobile commerce inherits e-commerce.

Adoption the mobile commerce technology is extension of existing e-commerce technologies. The existing e-commerce applications are serving the information on internet backbone while the mobile commerce application is serving the content in wireless communications devices (like, mobile, palmtop, PDA). Moving towards e-commerce to m-commerce XML and web services play great role. The business logic of the application remains same at the application layer but type of content deliver to the user is differ at the presentation layer.

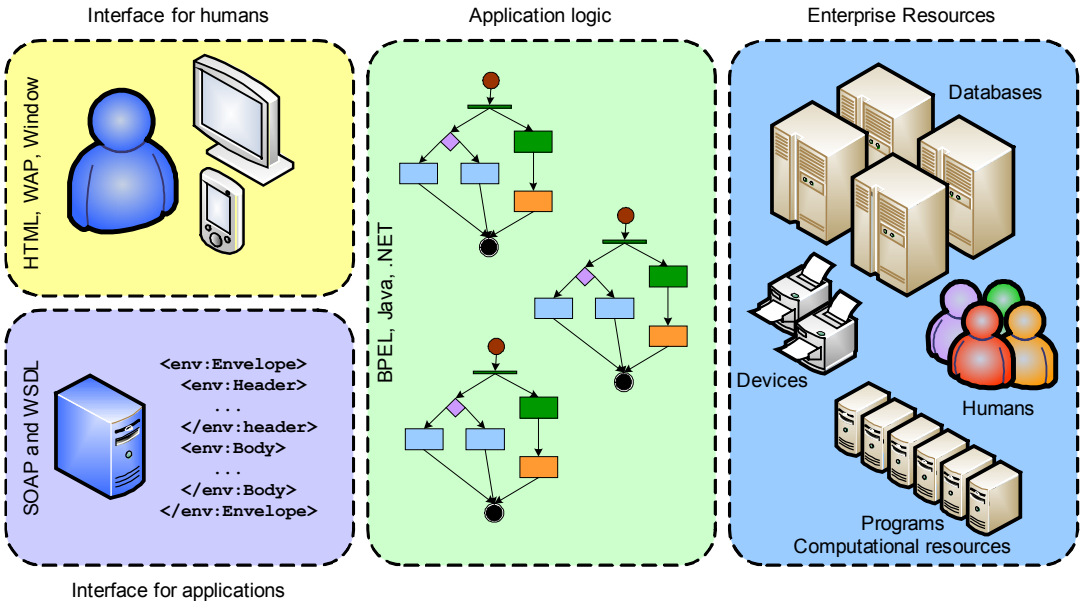


Fig. 1.10 Extension of e-commerce Application

1.4.4 Payment Options

"How users will pay for their m-Commerce purchases presents one of the key obstacles to the development of the market, no matter what region of the world is involved." Traditional payment infrastructures, credit and bank card systems, were not designed to deal with volume, or micro-size, of payments that m-commerce will generate. For instance, if instant messages cost fractions of penny, and a user sends dozens in a short time frame, how would a credit card company bill for that. Currently they would be unable to accommodate it. Luckily this has been a very active area of development in the m-Commerce world and several vendors and new start-ups are offering solutions, but much like the network infrastructure, in the end only a couple of these will gain widespread acceptance and use.18 One that may survive is a joint initiative by VISA, MasterCard and American Express, who are proposing a secure standard for credit card processing and presumably, micro payments. Mobile commerce need to be treated to handle all kind of payment including micro payment. Some sort of standard need to define what consumers want to purchase when they are mobile. Is it they are looking for all kind of purchase from the mobile devices or the purchase which comes under emergency when user is far away from their computer? Few people have any idea what users will pay for or how they will pay for it. Obviously, this will develop overtime, but the industry needs to start sooner, rather than later, so that the solutions can evolve along with the problem.

The availability of technology to support payment systems has often been identified as one of the factors limiting the widespread uptake of m-commerce. However, in reality the ability for consumers to access bank accounts to pay for goods and services using a mobile

phone is already available. The key issue is that, to date, no standardized, widely adopted mobile payment system has emerged. A number of payment models are expected to be able to support m-commerce transactions and existing billing and payment models have already been modified to handle purchases from mobile phones. New systems are also being developed by operators and financial service providers anxious to use the new m-commerce platform for goods and services transactions.

Carrier billing

The starting point for enabling m-commerce payments has been the ability to charge payments to existing telephone accounts. This approach has been adopted for micro payments, with telecommunications operators billing on behalf of third-party content providers. This model has been successfully implemented for both post-paid and pre-paid mobile services. It is already operational for the purchase of ring-tones and information services. This payment option is likely to continue to take precedence in the short term and could represent an important billing option particularly for smaller payments. With their infrastructure and billing relationship with customers already in place, operators have a considerable advantage over financial institutions and service providers for micro-payment charging. However, rather than being a true mobile payment (m-payment) solution, this has been defined as an m-billing solution. In the same way as Bpay, the m-payments solution is likely to continue being modified as standards develop. With a common technology, financial providers could compete on price and features without confusing customers, as Bpay operates today.

Credit card payments

M-commerce services are likely to provide the opportunity to pay from a credit card or debit account. This could be similar to what is already offered through fixed line phones, including making purchases or paying bills. Credit/debit card or other bank details could be entered and transmitted to the service provider over the phone via SMS. An alternative could be that a consumer makes an Arrangement with their bank and a merchant for all purchases being made from a particular phone to be charged to a nominated account. While this would eliminate the need for sending credit card details, it is likely that consumers would prefer to have the same banking choices. One interesting market development is currently being trialed by VISA where phone subscribers can download a soft version of their credit card details or insert a SIM-size chip into special m-commerce phones. These transmit payments to infra-red ports attached to terminals at selected merchants. While this could evolve to be a niche m-payments system, the issues of interoperability are likely to limit its attractiveness as a payment option.

Direct debiting from bank accounts

The industry is also examining systems that enable payments to be made directly to a merchant from a phone. To undertake the transaction, a personal identification number would be entered on the phone to authorize payment for specific services or goods. To be effective, however, this would require service agreements to be made between banks and telecommunications operators, as the mobile handsets could effectively become a personal terminal for a customer. The extent, to which this might lead to proprietary arrangements, where consumers only have one choice of banking service depending on the arrangements put into place by the

telecommunications providers, is an issue that could impact on uptake. The concept of electronic person to person payments has been developed to support secure electronic payments between individuals. The online payment service, PayPal, is now being adapted for mobile phones and would allow users to use their mobile to pay a bill or account, with the amount being charged to a credit card or bank account.

Stored-value phones

The third payment model that could underpin m-commerce transactions is the smart-phone, where money can be electronically loaded onto the SIM card in the phone and used by a consumer to make purchases. The telecommunications operator who manages the account for the phone would be billed by the merchant. This shares some similarities with both the way existing prepaid phones work and the carrier billing payment model (see above), as the process would not necessarily involve a financial service provider acting as a separate party in the payment process. While this process is likely to address some security issues, and would not require payment details to be transmitted over the network, it raises other issues, particularly for the amount of value a mobile phone can represent for a consumer. In Europe, non-financial institutions including ISPs and mobile network operators are looking to launch e-money schemes, where a cash value is stored on a PC, smart card or mobile phone. Companies are already developing chips containing credit card information that can be inserted into mobile phone handsets. This model is more likely to support micro-payments rather than macro-payments.

M-commerce Payment Model

	Carrier based billing	**Carrier based billing**	**Direct payment from phone**	**Stored value cards**
Ubiquity	Generally carrier/network specific. Carrier must have a billing relationship with the customer	Can be used over any network with the customer of any bank	Generally carrier/network specific	Can be used over any network with any merchants
Main target Market	Micro-transactions -low value, low risk	Medium to high value transactions	Medium to high value transactions	Micro-transactions –low value
Examples	Airline tickets, shopping	Information based services, ring-tones	Paying a bill, making purchases	Information based services, ring-tones

1.4.5 Security Concerns

Security concerns come in two flavours when m-Commerce is concerned. The first is security of data. Mobile devices, by definition are easy to lose and steal, so how do we protect the data contained within them and prevent misuse. Currently, not many devices store critical data locally, so this is not a large concern immediately, but in the future as the device itself is used to store sensitive data about the user, this will become a much larger issue. Devices could employ a thumb print or even voice recognition as a means of

activation. Whatever the solution it will have to satisfy the users desire to know that their personal information is secure.

Data is also susceptible to theft while it travels through the air to the wireless receivers and then across the internet to the servers processing the request. To provide protection from this type of information theft encryption will play a large role. In fact, even while surfing the web on a current handheld via Rogers AT&T, all traffic is encrypted and keys are generated and exchanged each time the browser is restarted. Aside from data security, there is personal security. If a users location is able to be deciphered with pinpoint accuracy, then some method has be developed to keep this information from being abused. If not, users will be reluctant to use the technology, fearing things such as stalking and harassment. Similarly, privacy concerns are also a concern, conceivably, a user's entire day could be mapped out via positioning of the mobile device. The question must then be posed: Who would have access to this, and what would they do with it? This has already been an issue on the World Wide Web with companies tracking users' movements, and using the information for marketing purposes. While this is more of a civil liberties concern, at some level the technology will have to deal with it (even if the rules are legislative the technology must still make them work). None of these issues are particularly difficult to overcome technically, however they are worth mentioning because of the effect they have on people's attitudes. If users lack confidence in the technology's ability to keep their private information secure, then they will either use it sparingly or not at all, either way it is bad news for m-Commerce market.
Securing m-commerce may be even more difficult than protecting wired transactions. Constrained bandwidth and computing power, memory limitations, battery life and various network configurations all come into play and raise the question whether there will be

adequate security for users without compromising the ease of use and speed. A key difference between m-commerce systems and other electronic systems over which transactions are handled is the identification of the customer and the merchant. In a mobile payment system, the identification is the mobile phone number. Wireless devices are easy to misplace and relatively easy to steal. As mobile phones become capable of storing more information and conducting more sophisticated information processing, consumers will have more information at stake if they lose their devices. This raises obvious questions for a merchant, in terms of how they authenticate the user, and for the consumer, who could be liable for unauthorized transactions if their phone is used without their permission. It is generally agreed that strong authentication procedures need to be in place to prevent security breaches. These need to be intuitive and transparent to users. The issue could be compounded by problems with the delivery of m-commerce messages. SMS is a store-and deliver system with no guarantee whatsoever that the message will get through. There are questions over the reliability of SMS. A January 2003 Keynote Systems study in the US found that 7.5 per cent of SMS messages are somehow lost. This raises the associated issue that consumers are being charged for SMS messages that do not reach their targets, and they may not be even aware of this problem. Network limitations could further compound authentication problems. Initial reports about Hutchison's new Australian 3G services have been somewhat disappointing. Early subscribers have complained about frequent dropouts, faulty handsets, poor battery life, unresponsive customer support and black spots.

Industry approaches to the issue

Currently, many mobile phones are enabled with locks to prevent unauthorized access to them. Advances in technology could allow the owner to lock the device from a remote location if it is lost. Other approaches being considered by equipment manufacturers include enabling users to load and unload their own privacy and security technologies and separating personal identifiers from transactional data. Wireless security could also be improved by implementing stronger authentication functions using public key infrastructure. In Europe, one standards working group is developing a small graphic that could be displayed on a phone to show that the transaction is secure. Using secure technology, such as that provided by smartcards and secure payment gateways, is the only way to maintain protection against financial risk and cover merchants and consumers against fraudulent transactions. The development of biometric security features on handsets and wireless digital certification will also give consumers more confidence in wireless banking. In June 2003, Japan's NTT DoCoMo said it would introduce SSL (Secure Socket Layer) security on its 3G service FOMA (Freedom Of Mobile Multimedia Access). A digital certificate is stored in a removable card in the handset and identifies the user to a mobile Internet trader.

In 1999 the European Commission adopted a legal framework guaranteeing EU-wide recognition of digital signatures. The Digital Signatures Directive 100 defines the requirements for digital certificates and certification services to ensure minimum levels of security and allow their free movement throughout. The Directive aims to facilitate the use of electronic signatures for online authentication and contribute to their legal recognition. Electronic signatures allow someone receiving data over electronic networks to

determine the origin of the data and to check that that data has not been altered. They are defined as "data in electronic form which are attached to or logically associated with other electronic data and which serve as a method of authentication". The Directive also defines certain requirements for certification service providers to ensure a guaranteed minimum level of security. The Directive is not designed to regulate everything in detail but defines the requirements for digital certificates and certification services so as to ensure minimum levels of security and allow their free movement throughout the Internal Market. Its main elements are:

- The Directive stipulates that an electronic signature cannot be legally discriminated against solely on the grounds that it is in electronic form
- all products and services related to electronic signatures can circulate freely and are only subject to the legislation and control by the country of origin
- the legislation establishes minimum liability rules for service providers who would, in particular, be liable for the validity of a certificate's content
- the legislation provides for legal recognition of electronic signatures irrespective of the technology used (e.g. digital signatures using asymmetric cryptography or biometrics.)
- the legislation covers the supply of certificates to the public aimed at identifying the sender of an electronic message
- the legislation includes mechanisms for co-operation with third countries on the basis of mutual recognition of certificates and on bilateral and multilateral agreements.

Under the Directive on Privacy and Electronic Communications, concerning online security and privacy, carriage service providers must inform customers of any security risks in transmitting data. Service providers who offer publicly available electronic

communications services over the Internet should inform users and subscribers of measures they can take to protect the security of their communications for instance by using specific types of software or encryption technologies. The requirement to inform subscribers of particular security risks does not discharge a service provider from the obligation to take, at its own costs, appropriate and immediate measures to remedy any new, unforeseen security risks and restore the normal security level of the service. The provision of information about security risks to the subscriber should be free of charge except for any nominal costs which the subscriber may incur while receiving or collecting the information, for instance by downloading an electronic mail message.

2.1 Implementation platform study

The very first need is to study the wireless technologies which originated as 1G and grown as 4G and model based implementation and issues related to implement action. The R & D started the study from Wireless System AMPS which is know as 1G wireless system to CDMA-2000 which comes under 4G wireless system. In the study of the wireless technology road map the research study also involved barrier services through which the model delivers the information set.

2.1.1 Analog Systems (1G)

First generation mobile phones were based on frequency modulated (FM) analog technology. This system is known as FDMA (Frequency Division Multiple Access). This system is working under analog mode and the data transmission rate is two low.

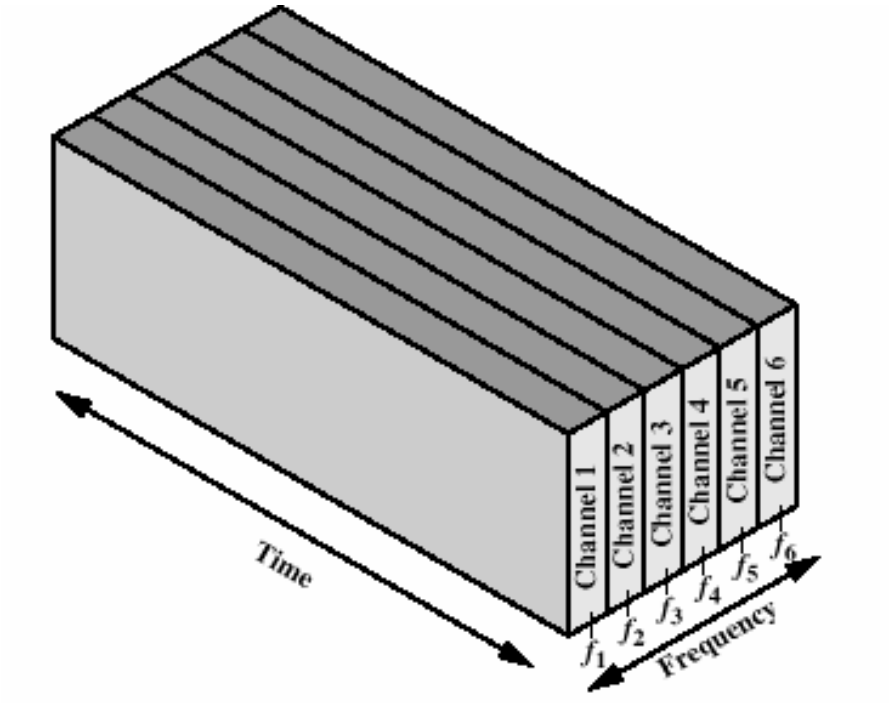


Fig. 2.1 Time Vs Frequency in 1G

Frequency-division multiplexing (FDM) takes advantage of the fact that the useful bandwidth of the medium exceeds the required bandwidth of a given signal.

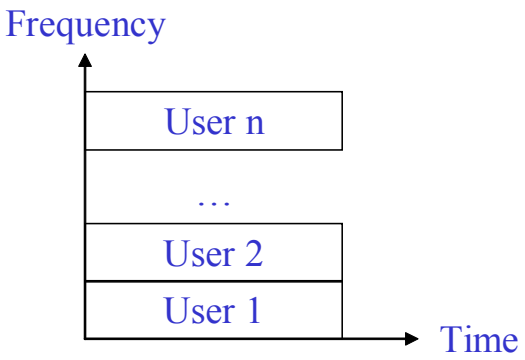


Fig. 2.2 Frequency Vs Time in 1G

Frequency channel is allocated to the user in time frame. Here the sharing of frequency between the users is not there. Following figure shows bandwidth allocation.

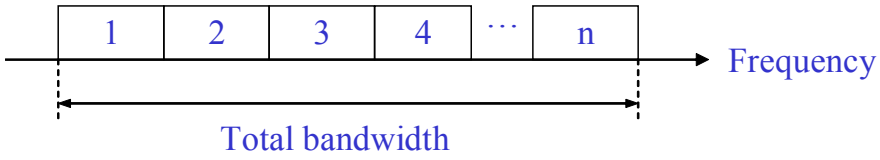


Fig. 2.3 Bandwidth allocation in 1G

Individual frequency channel is allocated to the user.

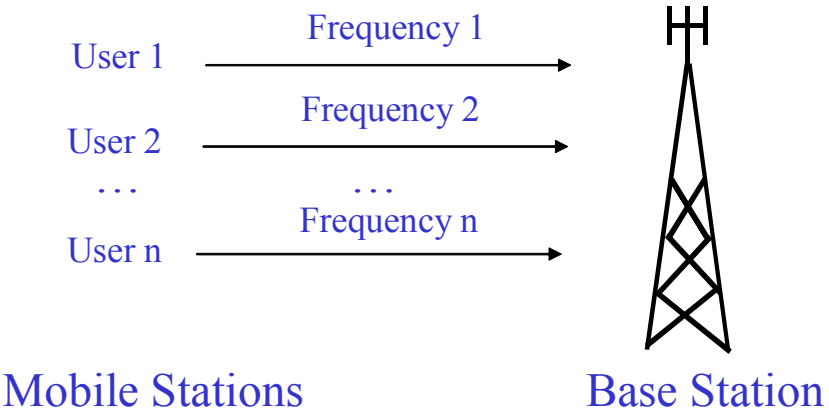


Fig. 2.4 Frequency channel allocation in 1G

- AMPS (Advanced Mobile Phone System) in American and Australia, support 10kbps data rate.
- ETACS in Europe (European Total Access Communications Systems), supports 8 kbps data rate.
- NTT in Japan (Nippon Telephone and Telegraphy), supports 0.3 kbps data.

1G mobiles Operates in the 900MHz frequency range and perform three parts to the communications: Voice channels, Paging Channels, Control Channels. FDMA breaks up the available frequency into 25 KHz channels and allocates a single channel to each phone call. The channel is agreed with the Base station before transmission takes place on agreed and reserved channel. Separate channels are allocated for uplink and downlink; this means no sharing of the medium is required. The device can then transmit on this channel, No other device can share this channel even if the person is not talking at the time. A different channel is required to receive. The voice/sound is transmitted as analogue data, which means that a large than required channel has to be allocated.

Each of the mobile devices need to operate on a unique frequency. This is given to the devices by the base station when communications are initially requested. The base station will give the phone a frequency in the range 890-915 MHz uplink and 935-960 MHz downlink. The downlink will then be allocated by the mobile device by adding 45 MHz to the uplink. So, 890 MHz uplink will be 935 MHz downlink.
The kinds of channels for communications are:
Fixed channels (always the same)

1. Paging Channels: BS through the transmission signals. The device catches the appropriate signals if the signal is for Incoming Call. The device also monitors this to see if another

Base Station has a stronger signal. If it does a handover takes place.

2. Control Channels: in the case where device wishes to make a call. Very first carry out a hand over and select frequency to communicate upon

Dynamic channels

3. Voice/traffic channels: These are allocated by the Base Station as per the uplink and downlink usage. If a channel is not available the phone will wait a random time interval and try again

If we take a look of the architecture of the 1G mobile system the main participants elements of the systems are Base Station and Mobile Switching Center. Base Station carries out the actual radio communications with the device. Sends out paging so that device will initiate the hand over and control signals also manage by Base Station. MSC is the second important element takes responsibility to controls all calls attached to this device, Maintains billing information as well Switches calls (Handover Process).

Cellular Architecture

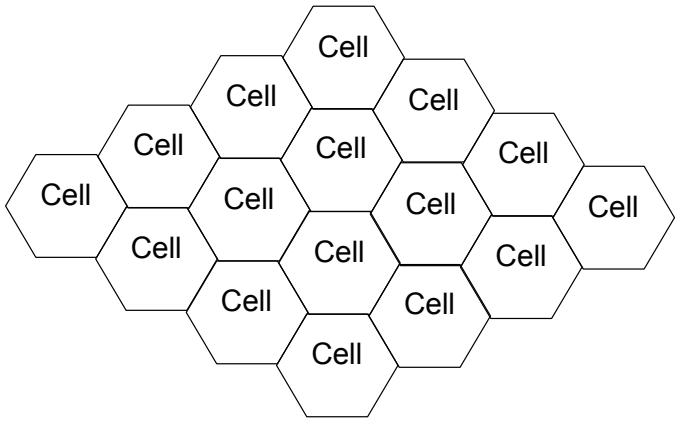


Fig. 2.5 Cellular Architecture (1) in 1G

To make ground level connectivity the area need to be broken into smaller cells. The mobile device then connects to the closest cell. Cellular architecture requires the available frequency to be distributed between the cells. If 2 cells next to each other used the same frequency each would interfere with each other. There must be a distance between adjoining cells. This distance allows communications to take place.

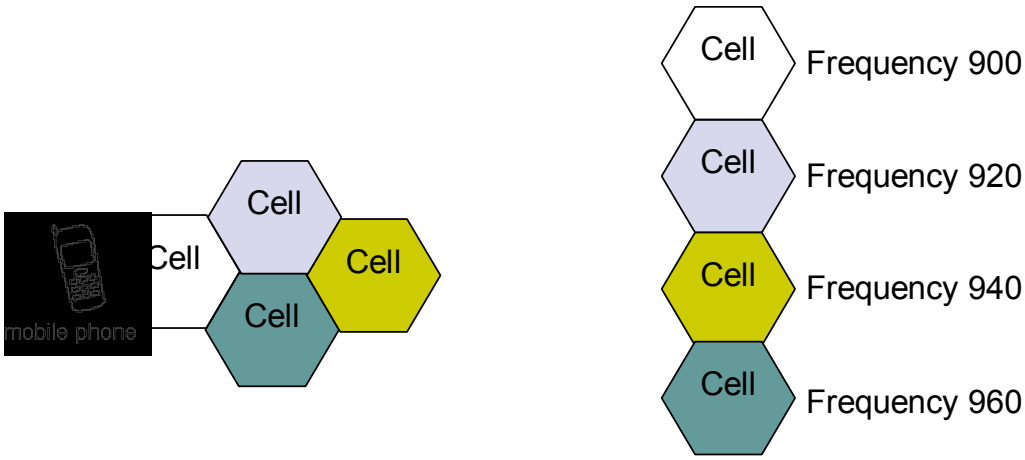


Fig. 2.6 Cellular Architecture (2) in 1G

This is referred to as the "Minimum Frequency Reuse Factor". This requires proper planning and can be an issue for all radio based wireless communications. Planning the radio cell and how far a signal may go. Logically we picture a cell as being a Octagon, In reality the shape of a transmission will change depending on the environment. We need to manage the Radio planning to make best ground level connectivity and for that every cell need to distinguish properly.

Radio Planning

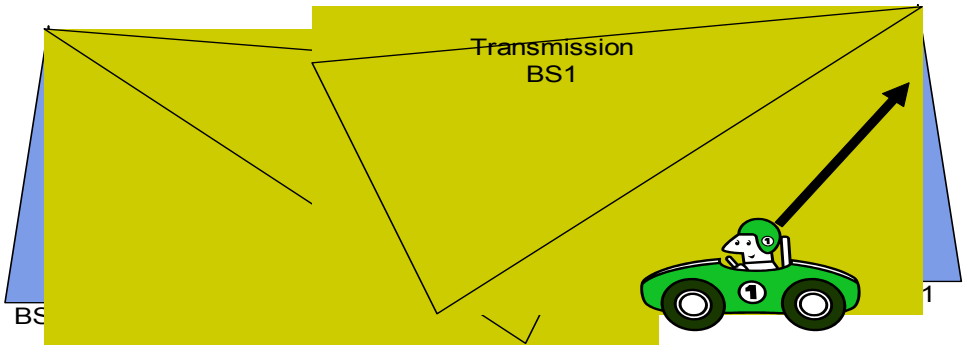
Planning needs careful thought, service provider must cover the entire area with the minimum of base stations. Base stations cost the company money and they also make the potential for radio problems greater. Simulations can be used but accurate models of the area are required. Best solution is to measure the signals at various points

From this a decision can be made.

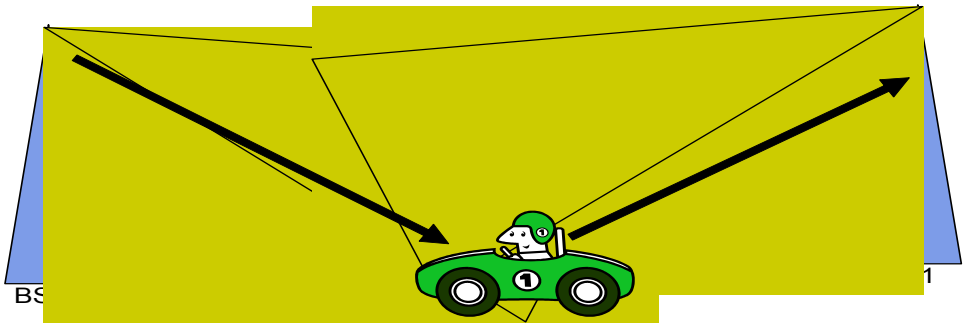
Cells with different frequencies allow devices to move between these cells. The device just informing what frequency they are communicating at which point. Cellular communications can only travel a certain distance. Cell sizes are flexible, like in the TUK TACS system were up to 50 Miles! Once System Administrator will get to the 'edge' of a cell System Administrator will need a handover. Handover allows the user to move between cells and get connected with the network. After a certain distance the amount of data which is sent in error becomes greater than the data sent correctly at this point, need to connect to a new cell which is closer. TACS carries this out by monitoring the amplitude of the voice signal.

The following figure explains handover.

Step-1: Communicating with BS1 and moving towards BS2



Step-2: Power of signal is weakening at the edge of BS1 cell



Step-3: Signal stronger so hand over to BS2

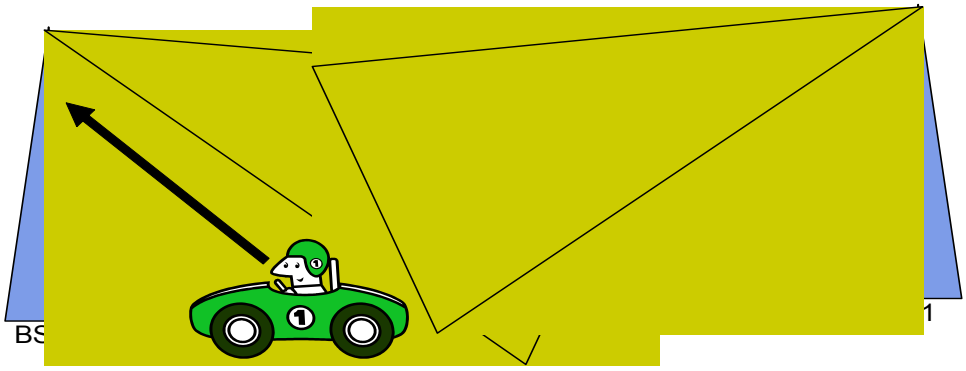


Fig. 2.7 Roaming in 1G

Once a handover is decided upon by the BS, the respective MSC is informed. All BS in the area of the current location are informed to start paging the device. The BS with the strongest signal is then took a charge of handed over. In reality a lot of calls were dropped whilst waiting for a handover to take place.

First Generation Mobile Technologies

- Advanced Mobile Phone Service (AMPS)
- Total Access Communication System (TACS)
- Nordic Mobile Telephone (NMT)

- Narrowband AMPS (NAMPS)
- Japanese Mobile Cellular System (MCS)
- CNET
- MATS-E

Problems founded in FDMA Technology

Roaming was not applicable properly because all of service provider was using different standards, different frequencies, different frequency spacing, different encoding technologies, Security. Even, calls were easily 'listened' upon. Limited capacity of the available spectrum is major problem. Analogue signal meant a larger than required amount of the frequency had to be allocated to each call. Expansion of the network was difficult as it need to take care of adjoin cell frequency.

So to overcome all the listed problems the new technology is evolved named GSM. The GSM is worked through TDMA as well as FDMA and it was started new era in the Wireless Technology as 2G. Second generation mobile network is working in Digital Medium based on Time Division Multiple Access. The same frequency channel is shared on the time frame. The same frequency is dividing in the time frames and passes across the network
Following figure illustrate the frame structure of TDMA system.

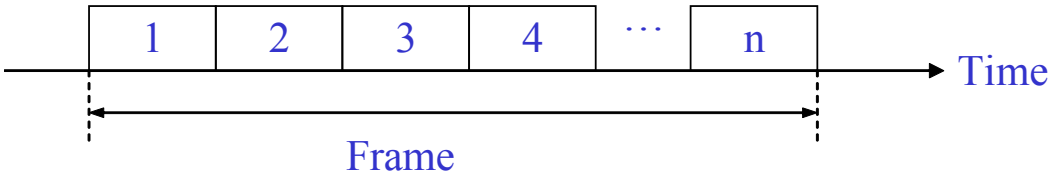


Fig. 2.8 Frame structure of TDAM

With frequency-division multiplexing different users use different parts of the frequency spectrum. Each user can send all the time at reduced rate. Hardware is slightly more expensive and is less efficient use of spectrum. While in case of time-division multiplexing different users send at different times. Each user can sent at full speed some of the time. Drawback is that there is some transition time between slots; becomes more of an issue with longer propagation times. The two solutions can be combined. The result is GSM system which combined TDMA and FDMA and the system is working on Digital mode.

2.1.2 Digital Cellular Systems (2G)

The second generation (2G) of the wireless mobile network was based on low-band digital data signaling. The most popular 2G wireless technology is known as Global Systems for Mobile Communications (GSM). GSM systems, first implemented in 1991, are now operating in about 140 countries and territories around the world. An estimated 248 million users now operate over GSM systems. GSM technology is a combination of Frequency Division Multiple Access (FDMA) and Time Division Multiple Access (TDMA).

The first GSM systems used a 25MHz frequency spectrum in the 900MHz band. FDMA is used to divide the available 25MHz of bandwidth into 124 carrier frequencies of 200 kHz each. Each frequency is then divided using a TDMA scheme into eight timeslots. The use of separate timeslots for transmission and reception simplifies the electronics in the mobile units. Today, GSM systems operate in the 900MHz and 1.8 GHz bands throughout the world with the exception of the Americas where they operate in the 1.9 GHz band. In addition to GSM, a similar technology, called Personal Digital Communications (PDC), using TDMA-based technology,

emerged in Japan. Since then, several other TDMA-based systems have been deployed worldwide and serve an estimated 89 million people worldwide.

The Second Generation (2G) wireless networks are also mostly based on circuit-switched technology. 2G wireless networks are digital and expand the range of applications to more advanced voice services, such as Called Line Identification. 2G wireless technology can handle some data capabilities such as fax and short message service at the data rate of up to 9.6 kbps, but it is not suitable for web browsing and multimedia applications.

Second Generation Mobile Technologies

- Global System for Mobile Communication (GSM)
- North American TDMA (IS-136 TDMA)
- Extended TDMA (E-TDMA)™
- Integrated Dispatch Enhanced Network (iDEN)
- Code Division Multiple Access (IS-95 CDMA)
- Japanese Personal Digital Cellular (PDC)

The research started study the popular Second Generation Technology Global System for Mobile Communication (GSM).

GSM Wireless Technology

Global System for Mobile Communication (GSM) is a digital wireless network standard designed by Standardization committees from major European telecommunications operators and manufactures. The GSM standard provides a common set of compatible services and capabilities to all mobile users across Europe and several million customers worldwide. The frequency allocations (ARFCN, or Absolute Radio Frequency Channel Number), are each 200 kHz in

bandwidth. The forward ARFCNs are between 935 and 960 MHz; the reverse ARFCNs are between 890 and 915 MHz, so that a given mobile unit receives at a frequency exactly 45 MHz greater than the one that it transmits. Since 1995, new bands have opened up at 1800 and 1900 GHz. Known as PCS (Personal Communication Services), vendors have been free to choose from a variety of standards. IS-95 is the standard used for CDMA applications, with some modification for higher rate data, while the GSM standard has also been moved up to the higher bands, under the names DCS 1800 and DCS 1900 (for 1800 and 1900 MHz, respectively). The principles described here also apply for the upper bands.

GSM Architecture

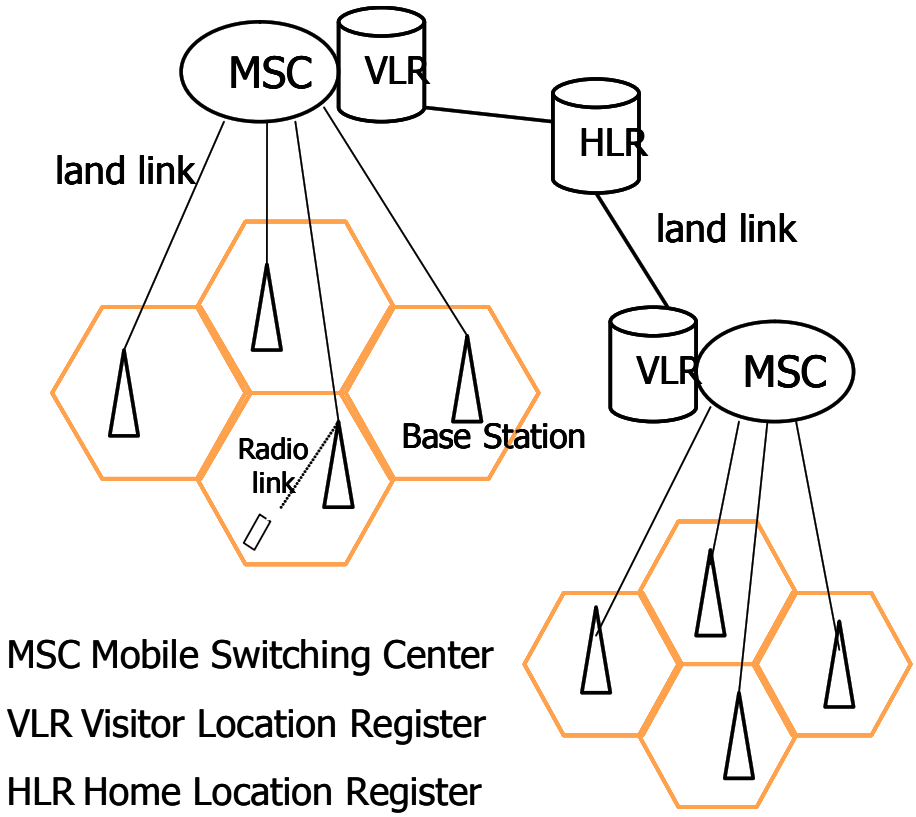


Fig. 2.9 GSM Architecture – 1

Following figure shows participants elements of GSM architectures and their connectivity link in more details.

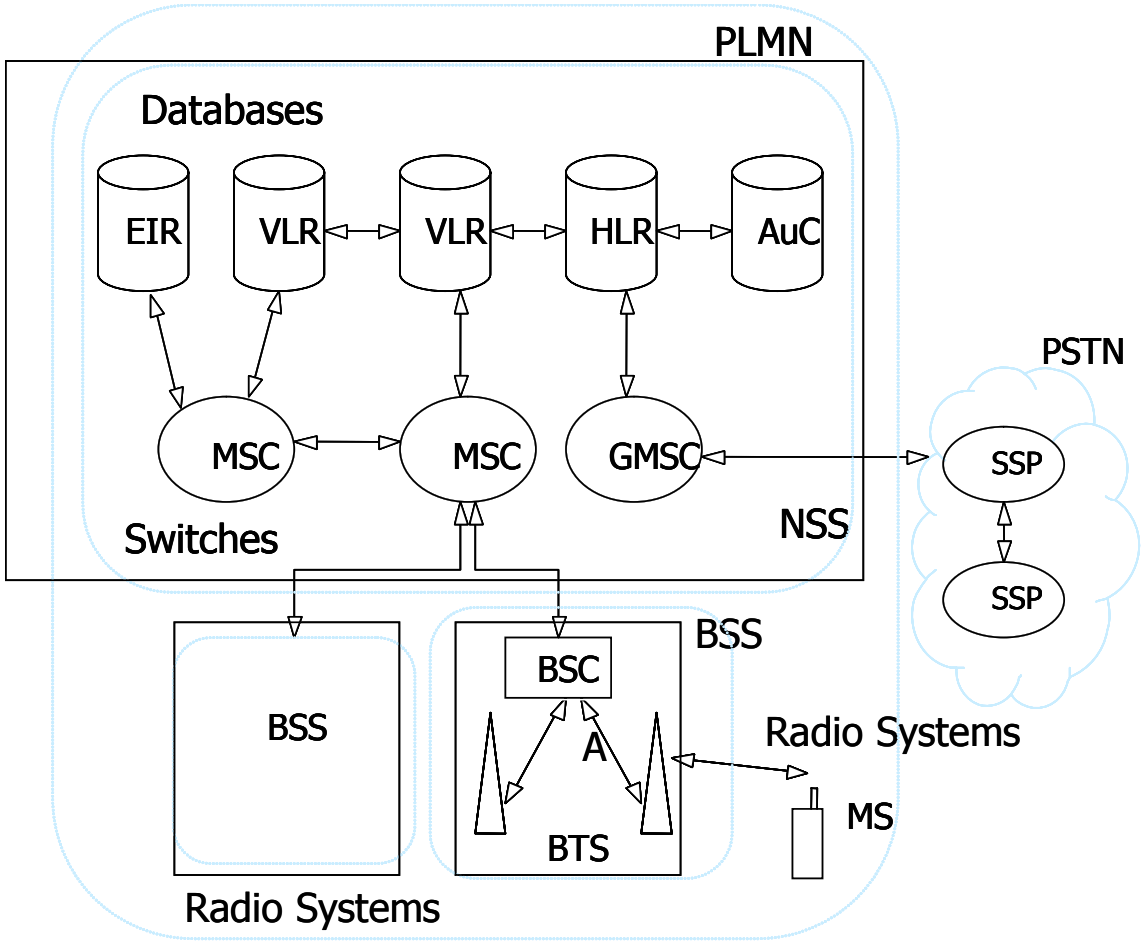


Fig. 2.10 GSM Architecture – 2

Mobile Station

The MS consists two parts: the Subscriber Identification Module (SIM) and the Mobile Equipment (ME). In a broader definition, the MS also include a third part called Terminal Equipment (TE), which can be PDA or PC connected to the ME. In this case, the first two parts (ME and SIM) are called Mobile Terminal (MT) and SIM can be:

- A smart card, usually the size of a credit card.
- A smaller-card "plug-in SIM"

- A smart card that can be performed, which contains a plug-in SIM that can be broken out of it.

The SIM is protected by a Personal Identification Number (PIN) between four to eight digits in the length. The PIN is initially loaded by the network operator at the subscription time. This PIN can be deactivated or changed by the user. To use the MS, the user is asked to enter the PIN. If the number is not correctly entered in the three connective attempts, the SIM is blocked and MS can't be used. To unblock the SIM, the user is asked to enter the eight-digit PIN Unblocking Key (PUK). A SIM contains the subscriber-related information, including the PIN and PUK codes. The subscriber-related data also include a list of abbreviated and customized short dialing number; short message received when the subscriber is not present, and the names of the preferred networks to provide service and so on. The ME contains the no customer-related hardware and software specific to the radio interface. When the SIM is removed from an MS, the remaining ME cannot be used for reaching the service, except for emergency calls.

Base Station System

The BSS connects Mobile Station (MS) and the Network and Switching Subsystem (NSS). The BSS consists of two parts: the Base Transceiver Station (BTS) and the Base Station Controller (BSC). The BTS contains transmitter, receiver, and signaling equipments to specific to the radio interface in order to contact the MSs. The BSC is responsible for the switching functions in BSS, and is in turn connected to an MSC in the NSS. The BSC supports radio channel allocation/relies. A BSC may connect to the several BTSs and maintain cell configuration data of these BTSs. The BSC communicates with BTSs using ISDN protocols via the A-bis interface. Capacity planning for BSC is very important. In busy

hours, the processor load of the BSC is roughly distributed over call activates (around 20%-25%), SMS (around 10%-15%), location update (20%-25%), and hardware checking/network-triggered events (around 15%-20%). A BSC is typically engineered at 80% utilization.

Networking and Switching Subsystem

The NSS supports the switching functions, subscriber profiles, and mobility management. The NSS consists MSC, HLR, VLR, AuC. The basic switching function in the NSS is performed by the MSC. The current location of MS is usually maintained by the HLR and VLR. When an MS moves from the home system to a visited system, its location is registered at the VLR of the visited system. The VLR then informs the MS's HLR of its current location. The Authentication Center (AuC) is used in the security data management for the authentication of subscriber. The AuC may be co-located with the HLR. The MSC is called the gateway MSC (GMSC). An MSC can functions, and by provisioning interface and the signaling link to the HLR. The GMSC obtains the location information and routes the calls to the visited MSC of the subscribers to receive the calls.

Mobile Switching Center

The main component here is the MSC. The MSC contains the Home Locator Register (HLR), Visitor Locator Register (VLR), and Authentication Center (AUC). These are the most interesting non-RF related parts of the system back end.

HLR (Home Location Register)

The HLR contains a lot of interesting information. The HLR is responsible for subscription details, and supplementary services. It also maintains information on the last know location and status of a particular phone. Since a user can use any phone with his or her SIM card, there's a protocol necessary to manage accessing the network. Information contained on the SIM card is transmitted to the HLR to verify the identity of the subscriber. Location and status are continually updated in the HLR based on the base station reports and cell phone status. Any messages to be sent to the subscriber are queued in the HLR. All call setup queries ask the HLR for information before doing anything else.

VLR (Visiting Location Register)

Like the HLR, the VLR keeps track of users but only within the area that the VLR is assigned. The VLR communicates with the HLR to figure out where to route calls, and to keep track of people as they move around.

AUC (Authentication Center)

The AUC is basically just database full confidential subscriber information attached to the back of the HLR. It is located in a "secure place" and the data is stored in "coded" form (sounds like encryption to me). The AUC is responsible for controlling the rights of usage of the network services, i.e. phone calls, data, internet, etc... The AUC allows the Network Operator to know "unambiguously" who is on the network for billing purposes. The AUC also protects the user from fraud (somehow ...) and contains the secret information necessary to handle authentication and encryption.

The functions of HLR, VLR, and AuC are inter connected in Mobile Switching Center. AuC manage the authentication Data and HLR and VLR manage the location updating data.

Location Tracking and Call Setup

The current location of an MS is maintained by a two-level hierarchical strategy with HLR and the VLRs. When an MS visits a new location, it must register in the VLR of the visited location. The HLR must also be informed about the registration. To access the MS, the HLR is queried to find the current VLR of the MS. The registration process of the MS moving from one VLR to another VLR is illustrated in figure and is described in the following steps.

Step 1: The MS periodically listens to the broadcast from BSS. If the MS detects that it has entered a new location area, it sends a registration message to the new VLR.

Step 2: The new VLR communicates with the old VLR to find the HLR of the MS. The VLR then performs the authentication process.

Step 3: After the MS is authenticated, the new VLR sends a registration message to the HLR. If the registration request is accepted, the HLR provides the new VLR with the relevant subscriber information for call handling.

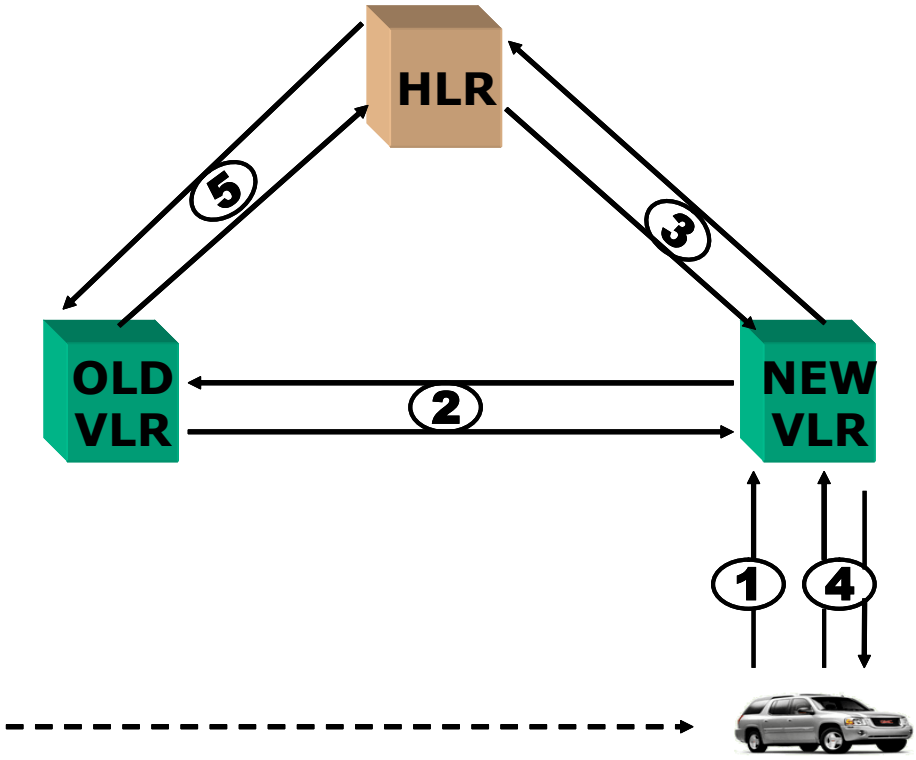


Fig. 2.11 Location tracking and call setup

Step 4: The new VLR informs the MS of the successful registration.

Step 5: After step 3, the HLR sends a deregistration message to the old VLR. The old VLR cancels the record for the MS and sends an acknowledgment to the HLR for the cancellation.

The Mobile call delivery procedure

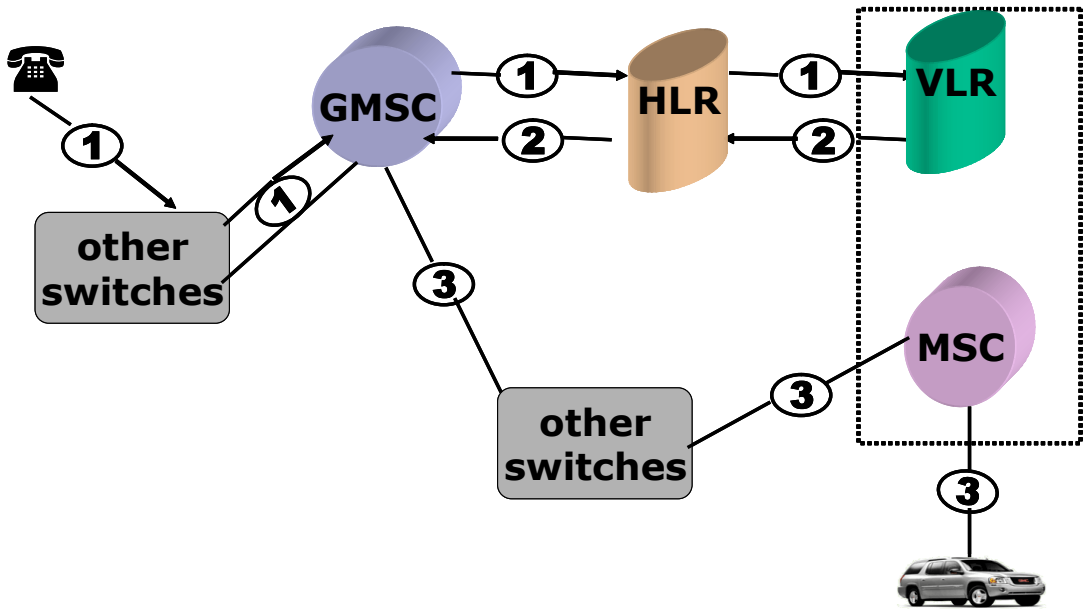


Fig. 2.12 Mobile call delivery procedure

The basic phone will enter through gateway GMSC which is a kind of simple MSC but it is behaving like a bridge in the different cellular network and the basic network. From the GMSC the call is forwarded to MS in the same manner as it transfers from inter network call.

Step 1: When the MSISDN is dialed, the call is forwarded to the GMSC, a switch that has the capability to interrogate the HLR for routing information. The HLR requests the current VLR of the MS to provide the routable address, called Mobile Station Roaming Number (MSRN).

Step 2: The VLR returns the MSRN to the GMSC through the VLR.

Step 3: The GMSC uses the MSRN to route the call to the MS through the Visited MSC.

GSM Security

Security issue is the important part for any network. The GSM network security is addressed in two aspects: authentication and encryption. Authentication avoids fraudulent access by a cloned MS. Encryption avoids unauthorized listening. A secrete key, Ki is used to achieve authentication. Ki is stored in the AuC as well as in the SIM. The Ki value is unknown to the subscriber. To initiate the authentication process, the home system of the MS a 128 bit random number called RAND. This number is sent to the MS. By exercising an algorithm, A3, both the network (AuC) and the MS (SIM) use Ki and RAND to produce signed result (SRES). The SRES generated by the MS is sent to the home system and is compared with the SRES generated by AuC. If they are not identical, the access request is rejected. If the SREC and RAND generated by the the AuC are sent from the HLR to the visited VLR in advance, the SREC comparison can be done at the visited VLR. Since the visited system may not know the A3 algorithm of a roaming MS, authentication result SRES is generated at the home system. Algorithm A3 is dependent on the GSM service provider. If the MS is accepted for access, an encryption Kc is produced by an algorithm, A8, with Ki and RAND as inputs Like A3, A8 is specify to the home system. After the home system has generated Kc , the encryption key is sent to the visited. Kc and the TDMA frame number encoded in the data bits are used by an algorithm, A5, to cipher and deciphering the data stream between the MS and the visited

system. The same A5 algorithm may be used in all systems participating in the GSM services.

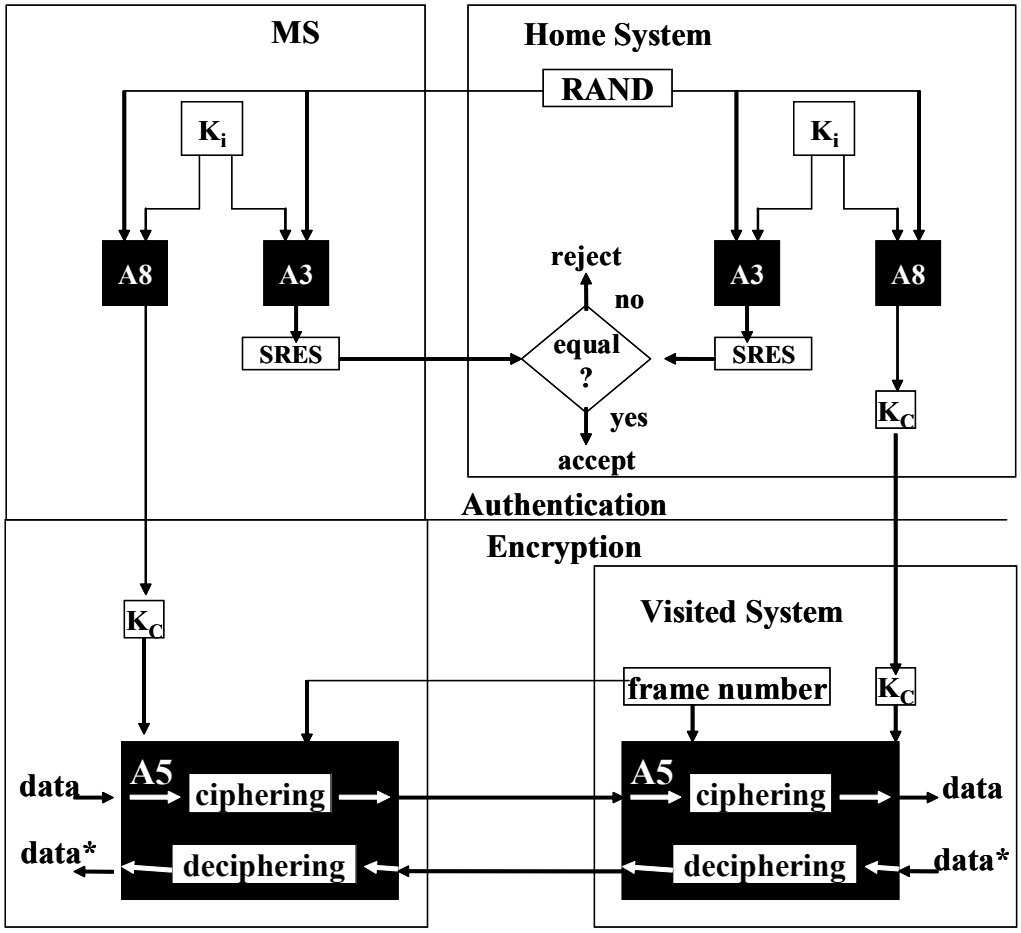


Fig. 2.13 GSM Security

GSM Success Story

International Roaming

At the core of the GSM philosophy was the concept that a single standard would provide subscribers seamless and standardized contact ability, regardless of national boundaries. The ability to

roam, or use one's mobile on any other GSM network globally, is raised of GSM. The GSM system enhances personal mobility by allowing the user to have access to all subscribed services, irrespective of a specific mobile phone handset, through the property of a removable SIM. By decoupling the subscriber's identity from the mobile handset, roaming on GSM networks is simplified, thus allowing GSM phones to be easily rented or borrowed. Even using GSM networks operating on different bands is as simple as moving the SIM from one handset to another. In the era prior to multi-band phones, travelers were able to avoid carrying multiple phone handsets, only needing to carry their personal SIM. Global roaming, facilitated via the unique authentication feature of the SIM, has contributed greatly to the success of GSM, allowing the delivery of services to users across continents, which has boosted mobile operator revenues and resulted in a growing subscriber base. Even the SMS service or text messaging, mentioned earlier, supports international roaming with very low latency, enabling users to exchange alphanumeric messages (up to 160 characters) with other users of GSM, almost anywhere in the world within seconds of submission. SMS has become particularly suitable for applications such as paging, email and voice mail notification, and messaging services for roaming users.

Calls from mobile subscribers traveling abroad have given a significant impetus to traffic growth; generating calls that might otherwise not have been made. The rapid rise in GSM with its huge footprint worldwide has made it easy, although not necessarily cheap, to use a mobile phone when roaming from one country to another. According to research conducted by Tele-Geography, which maps the pattern of telephone traffic, more than one in four international phone calls is being made from a mobile phone.

Standardization

Standards such as GSM are essential not just for the efficient working of the world's vast communications networks, but also as a key driver for economic growth. They bring economies of scale by focusing R&D to one large market, lowering development costs and setting the stage for better choice and innovation. They reduce technical barriers and promote compatibility between systems that, in turn, bring benefits to manufacturers, network operators and consumers. From the outset, GSM's commitment to openness and interoperability, coupled with its compatibility with ISDN and Intelligent Networking concepts, fostered innovation and competition. This resulted in a single infrastructure based on common industry standards, which was equally accessible to all market participants. More importantly, it enabled operators to procure key network elements that give a high degree of flexibility, lower terminal and infrastructure costs and independence in their implementation, which eventually lead to lower costs for consumers. Before GSM, operators were tied to the proprietary interfaces within their networks, which were inherent in the original equipment, with no real ability to adapt them without the vendor's concurrence, or even to substitute vendors at a later stage.

Conversely in Japan and the US - where GSM was not initially adopted it was common to have the network operator produce handsets and network equipment, provide mobile services and sign contracts with content providers. In such an environment, consumers could not easily switch from one network operator to another, which stifled competition and technological innovation. Moreover, the proliferation of multiple networks of varying conflicting standards in the US resulted in sparse national coverage,

lacking interoperability and thwarting potential subscribers from roaming outside their regular service area.

Economies of scale

By focusing R&D to one large market, the advent of the GSM standard reduced development costs and provided suppliers with huge economies of scale in both network elements and handsets. Today, GSM's maturity and widespread production makes it far more price competitive than any other mobile technology. While GSM is identified as a European standard, it is actually the de facto global standard that entitles any manufacturer around the world - even those who did not contribute to the Intellectual Property of GSM - to manufacture products. Consequently, North American and Asian manufacturers have manufactured GSM equipment and handsets, which has led to further economies of scale. The unparalleled economies of scale created by GSM as a unified system that provided affordable mobile communications services by a single identity number, through a pocket sized mobile terminal, regardless of the characteristics of the country of residence, are enough to justify its implementation. It also provides a significant convenience to people, while having an impact on private lifestyles and business practices, through carrying just one communications terminal anywhere they go, regardless of national boundaries.

Code schema

For radio systems there are two resources, frequency and time. Division by frequency, so that each pair of communicators is allocated part of the spectrum for all of the time, results in Frequency Division Multiple Access (FDMA). Division by time, so that each pair of communicators is allocated all (or at least a large

part) of the spectrum for part of the time results in Time Division Multiple Access (TDMA). In Code Division Multiple Access (CDMA), every communicator will be allocated the entire spectrum all of the time. CDMA uses codes to identify connections.

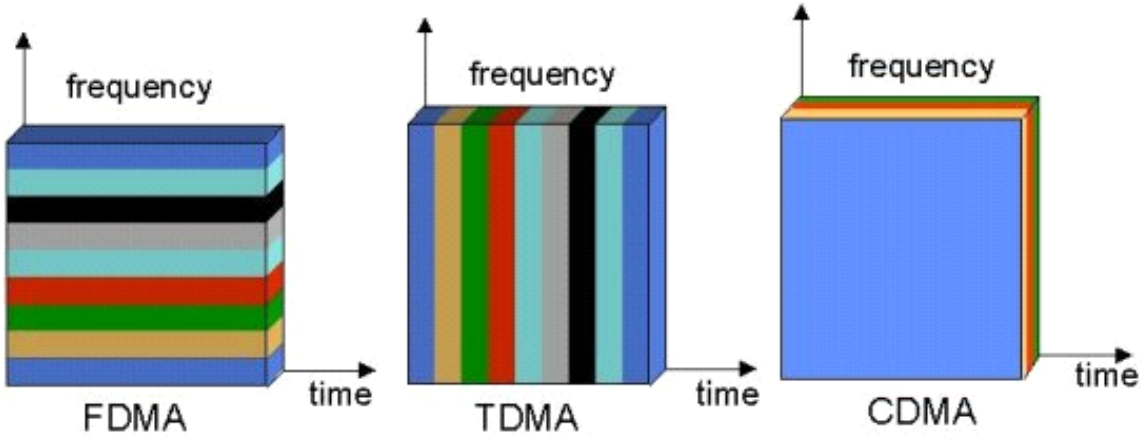


Fig. 2.14 Frequency vs. Time in FDMA, TDMA, CDMA

IS-95 Cellular System (Code Davison Multiple Access – CDMA)

The IS-95 standard describes a Code Division Multiple Access (CDMA) system in which the audio band data signal is multiplied by a high rate spreading signal. This spreading signal is formed from a pseudo-noise code sequence, which is then multiplied by a Walsh code for maximum orthogonality to (i.e. To have low cross-correlation with) the other codes in use in that cell. Typically, CDMA pseudo-noise sequences are very long, thereby giving excellent cross correlation characteristics. (IS-95 uses a 2^{42}-1 chip period, derived from a 42 bit mask.)

CODING

CDMA uses unique spreading codes to spread the base band data before transmission. The signal is transmitted in a channel, which is below noise level. The receiver then uses a correlator to dispread the wanted signal, which is passed through a narrow band pass filter. Unwanted signals will not be dispread and will not pass through the filter. Codes take the form of a carefully designed one/zero sequence produced at a much higher rate than that of the base band data.

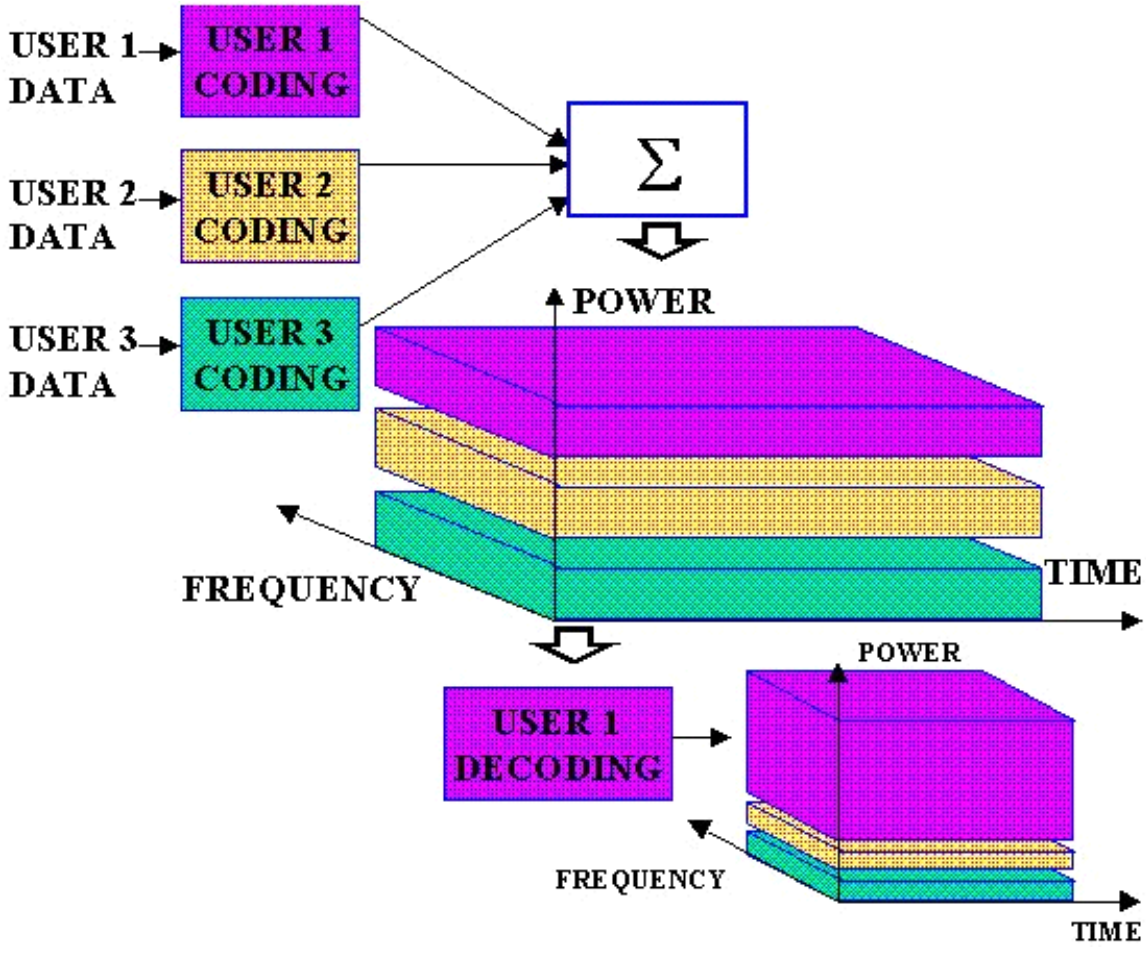


Fig. 2.15 CDMA coding schema

POWER CONTROL

CDMA is interference limited multiple access system. Because all users transmit on the same frequency, internal interference generated by the system is the most significant factor in determining system capacity and call quality. The transmit power for each user must be reduced to limit interference, however, the power should be enough to maintain the required Eb/No (signal to noise ratio) for a satisfactory call quality. Maximum capacity is achieved when Eb/No of every user is at the minimum level needed for the acceptable channel performance. As the MS moves around, the RF environment continuously changes due to fast and slow fading, external interference, shadowing , and other factors. The aim of the dynamic power control is to limit transmitted power on both the links while maintaining link quality under all conditions. Additional advantages are longer mobile battery life and longer life span of BTS power amplifiers.

HAND OVER process in CDMA

Handover occurs when a call has to be passed from one cell to another as the user moves between cells. In a traditional "hard" handover, the connection to the current cell is broken, and then the connection to the new cell is made. This is known as a "break-before-make" handover. Since all cells in CDMA use the same frequency, it is possible to make the connection to the new cell before leaving the current cell. This is known as a "make-before-break" or "soft" handover. Soft handovers require less power, which reduces interference and increases capacity. Mobile can be connected to more that two BTS the handover.

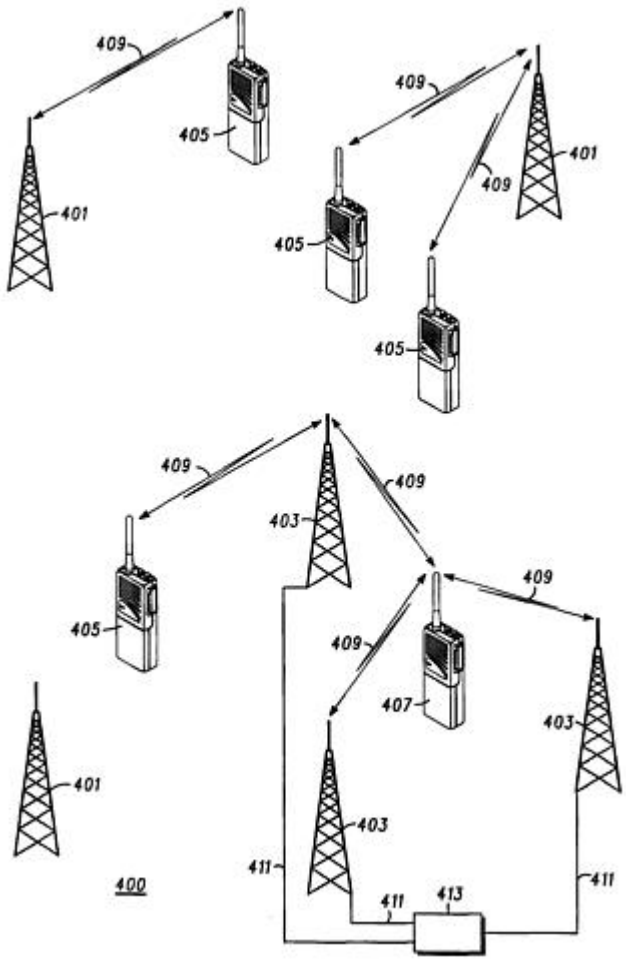


Fig. 2.16 (3 Way Soft Handover in CDMA)

The IS-95 system can be thought of as having many layers of protection against interference. It allows many users to co-exist, with minimal mutual interference. They can be described by the signal conditioning sequence that occurs on forward and reverse channels.

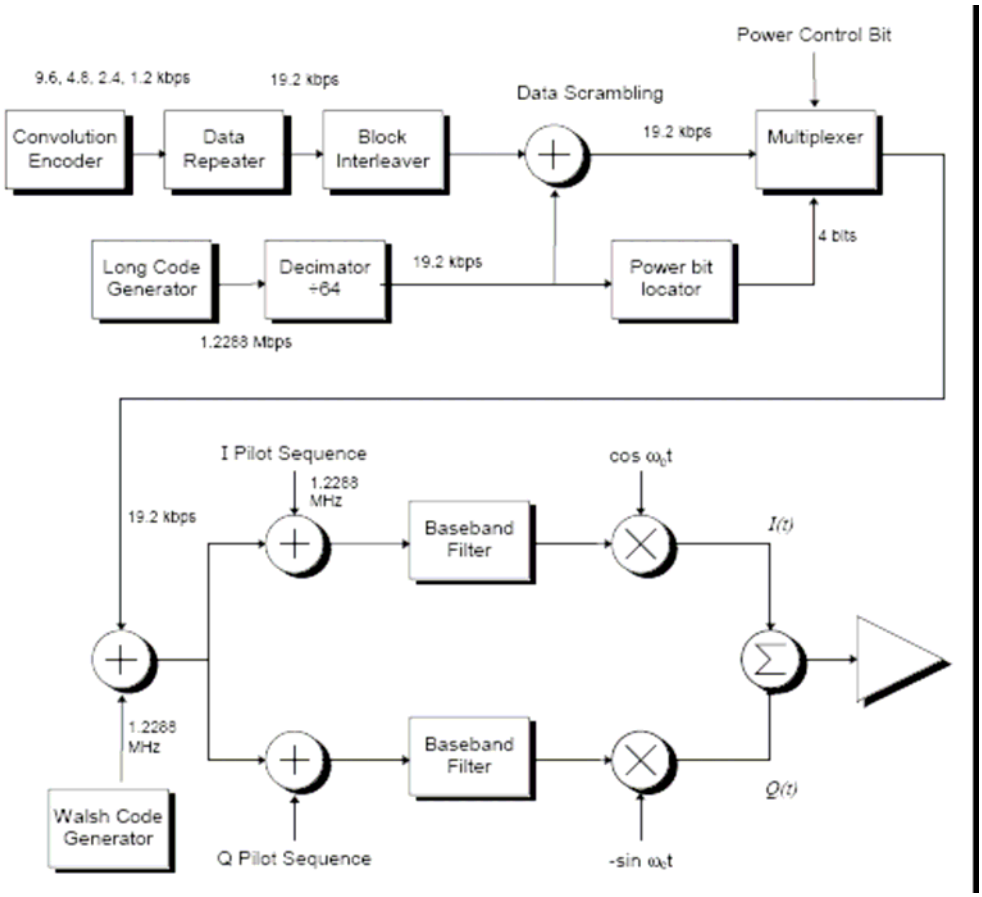


Fig. 2.17 Forward CDMA Channel

The forward channel carries information from the base station to the mobile unit; the reverse channel carries information from the mobile unit to the base station. The transmission channels are shown; the reception of each channel follows the reverse sequence. The forward channels are between 869 and 894 MHz, while the reverse channels are between 824 and 849 MHz. Within these bands, four sub-bands are available for CDMA, of widths 1, 0.1, 9 and 10 MHz; in the U.S., 1.25 MHz sub-bands near 849 and 894 MHz are employed. All cells in the same area can employ the same spectral band, because the various signals are sorted out by the spread spectrum process rather than by frequency discrimination.

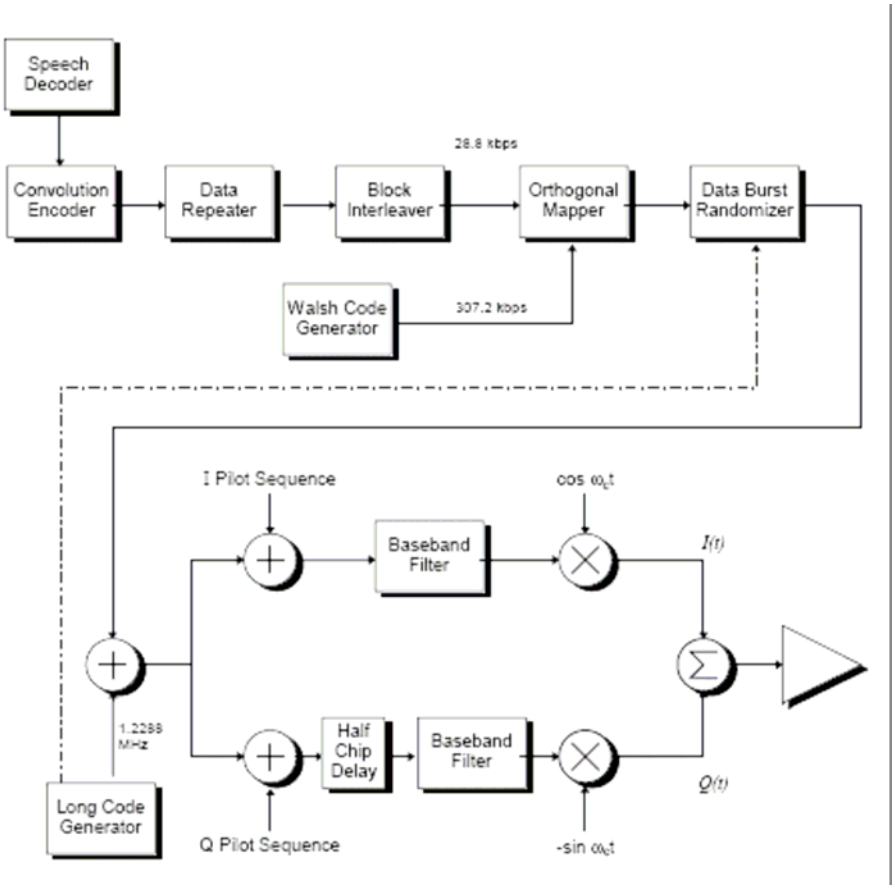


Fig. 2.18 Reverse CDMA Channel

Advantages of CDMA Cellular

- Higher capacity
- Improves voice quality (new coder)
- Soft-handoffs
- Less power consumption (6-7 mW)
- Choice for 3G systems
- Frequency diversity – frequency-dependent transmission impairments have less effect on signal
- Multi path resistance – chipping codes used for CDMA exhibit low cross correlation and low autocorrelation
- Privacy – privacy is inherent since spread spectrum is obtained by use of noise-like signals

- Graceful degradation – system only gradually degrades as more users access the system

Drawbacks of CDMA Cellular

- Self-jamming – arriving transmissions from multiple users not aligned on chip boundaries unless users are perfectly synchronized
- Near-far problem – signals closer to the receiver are received with less attenuation than signals farther away
- Soft handoff – requires that the mobile acquires the new cell before it relinquishes the old; this is more complex than hard handoff used in FDMA and TDMA schemes
- Air-interface is the most complex
- Not symmetrical (unlike TDMA)
    - Forward and reverse channels are different
    - Forward channel (1☐☐Many) synchronized
    - Forward channel uses orthogonal spreading codes
    - Reverse channel transmissions are not synchronized
    - Orthogonal codes are used for orthogonal waveform coding

Conclusion

2G is powerful digital wireless communication technology but it is not able to fulfill the significant demand of advance usages and application requirement and data delivery on internet backbone. Technological extension was highly expected to fulfill the needs. The next generation wireless technology has given dramatically change towards mobile computing. And the Third Generation Mobile Technology began.

2.1.3 Upgraded Digital Cellular System (2.5G)

2.5G is the interim solution for current 2G networks to have 3G functionality. 2.5G networks are being designed such that a smooth transition (software upgrade) to 3G can be realized. 2.5G networks currently offer true data speeds up to 28kbps. In comparison, the theoretical speed of 3G can be up to 2 Mbps, i.e., approximately 200 times faster than previous 2G networks. This added speed and throughput will make it possible to run applications such as streaming video clips. 2.5G networks, which are still not available everywhere, are essentially General Packet Radio Service (GPRS) packet overlays on 2G networks. Besides enhancing GSM and TDMA networks by making them packet-based networks, GPRS also increases their data rates. GPRS is primarily a software upgrade of GSM.

Some characteristics of 2.5G networks are:

- Data rates of 64 – 144kb/second.
- Packet based.
- Always-on connectivity.
- Instant messaging with small attachments.

A new wireless standard, Enhanced Data GSM Environment (EDGE), has been developed to increase the bandwidth of GPRS. EDGE triples the bandwidth capacity of GPRS to 384 Kbits/second thus allowing GSM and TDMA operators to offer high-speed services. EDGE based networks fall in between 2.5G and 3G networks.

General Packet Radio Service (GPRS)

GPRS is seen as a closer step towards UMTS with increased data speeds – will sit somewhere in between 2G and 3G rates – it will introduce a more functional medium in which consumers will see the potential of 3G. GPRS is an overlay technology that is added on top

of existing GSM systems. In other words, the GSM part still handles voice, and handsets are capable of supporting both voice and data (via the overlay) functions. GPRS essentially supplements present-day circuit-switched data and short message services (SMS), and serves as an enabler of mobile wireless data services, and an optimizer of the radio interface for bursty packet mode traffic. The upgrade to GPRS is easy and cost effective for operators, as only a few nodes need to be added. According to the Dec 1998/January 1999 issue of Mobile Communications International, "…the move to GPRS will be worth the expense because it will position operators well for 3G. Once carriers have built a packet subsystem for GPRS, they will be able to add additional 3G services as needed through co-sited GSM and WCDMA base station subsystems."

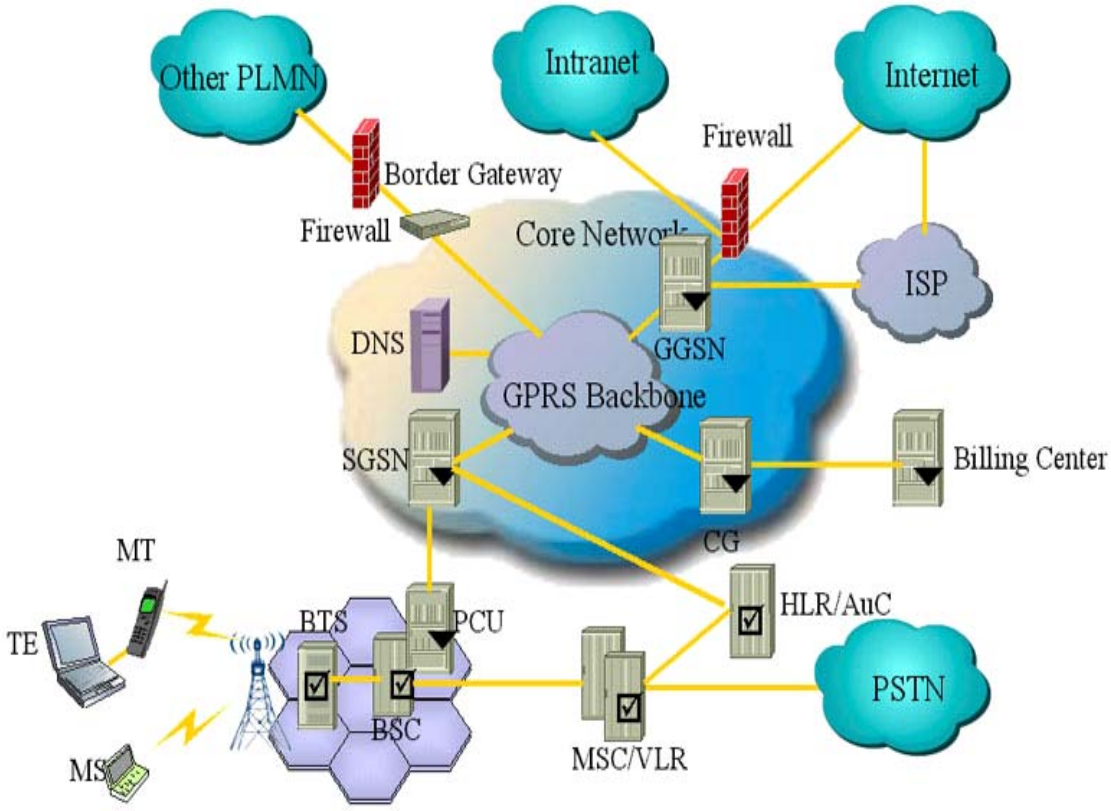


Fig. 2.19 GPRS Network

GPRS Network

GPRS is packet-based and promises data rates from 56 up to 114 KBPS, as well as continuous connection to the Internet for mobile phone and computer users. More specifically, packet-switching means that GPRS radio resources are used only when users are actually sending or receiving data; available radio resources can be concurrently shared between several users. This efficient use of scarce radio resources means that large numbers of GPRS users can potentially share the same bandwidth and be served from a single cell. The actual number of users supported depends on the application being used and how much data is being transferred. Because of the spectrum efficiency of GPRS, there is less need to build in idle capacity that is only used in peak hours. GPRS therefore lets network operators maximize the use of their network resources in a dynamic and flexible way, along with user access to resources and revenues. GPRS is essentially based on "regular" GSM (with the same modulation) and is designed to complement existing services of such circuit-switched cellular phone connections such as SMS or cell broadcast. GPRS should improve the peak time capacity of a GSM network since it simultaneously transports traffic that was previously sent using Circuit Switched Data through the GPRS overlay, and reduces SMS Center and signaling channel loading. In theory, GPRS packet-based service should cost users less than circuit-switched services since communication channels are being used on a shared-use, as-packets-are-needed basis rather than dedicated only to one user at a time. It should also be easier to make applications available to mobile users, and WAP or i-mode should be far more attractive for the user. In addition to the Internet Protocol, GPRS supports X.25, a packet-based protocol that is used mainly in Europe. GPRS for the time being has fallen short of theoretical 171.2 KBPS maximum speed, one reason being the

technical limitations of currently available handsets. Nevertheless, GPRS rollouts are expected to help counterbalance previous disappointments associated with WAP-based services/technology; hope is not lost, particularly according to the Gartner Group, that WAP can be a primary driver for mobile data revenue growth in the next three to five years. GPRS has the potential to 'help WAP get back on its feet again', according to John Hoffman of the GSM Association.

Packet-switched technique vs. circuit-switched

In circuit-switching, resources (e.g. a channel) are allocated to user for duration of connection

- Inefficient use of resources
- User pays for the whole connection
- High QoS: channel maintains real-time connection
- Low bit rates (maximum 14.4KBPS)
- Long access times
- Unfriendly bill (based on duration)
- Limited application support

In packet-switching, resources are allocated to user only for the time it takes to send each packet

- A channel can serve many users
- User pays by the packet
- Ideal for bursty data connections
- High bit rates (up to 170KBPS)
- Short access times
- Friendly bill (based on volume)
- Robust application support

GPRS Architecture

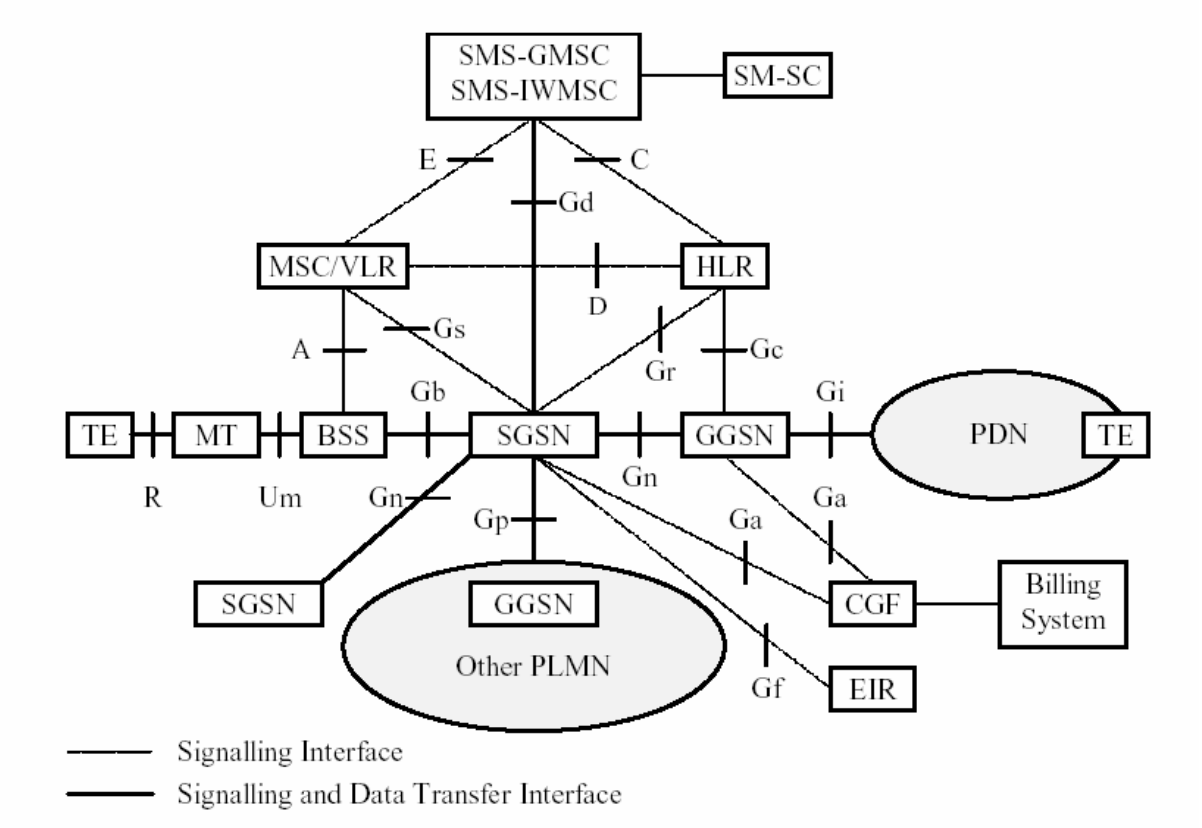


Fig. 2.20 GPRS Architecture

Upgrade Components in GSM Network for GPRS services

HLR: Enhanced with GPRS subscription data and routing information. Accessible from the SGSN and GGSN (added component in GPRS services to exiting GSM Network)

MSC/VLR: Not needed for routing of GPRS data. Needed for the co-operation between GPRS and the other GSM services. e.g. ,Paging for circuit-switched calls that can be performed more efficiently via the SGSN. Combining GPRS and non-GPRS location updates. Receives location information from SGSN or sends paging requests to SGSN via the Gs interface.

Mobile Station (MS): GPRS MS includes two components: MT (Mobile Terminal). Typically a handset used to access the radio interface. TE (Terminal Equipment). Typically a laptop or a Personal Digital Assistant (PDA). Could be one unit combing the functionalities of a MT and a TE

Three types of MS:

Class-A: Could be attached to both GPRS and other GSM services, and the MS supports simultaneous operation of GPRS and other GSM services.

Class-B: Could be attached to both GPRS and other GSM services, but the MS can only operate one set of services at a time.

Class-C: Could be exclusively attached to one service type at a given time.

New Components in GSM Network for GPRS services

SGSN – Serving GPRS Support Node

It reside the same hierarchical level as the MSC in GSM Network. Transfers data packets between mobile stations and GGSNs. SGSN Keeps track of the individual MSs' location and performs security functions and access control. Detects and registers new GPRS mobile stations located in its service area. It also participates into routing, as well as mobility management functions.

GGSN – Gateway GPRS Support Node

GGSN Provides inter-working between PLMN and external packet-switched networks. It Converts the GPRS packets from SGSN into the appropriate packet data protocol format (e.g., IP or X.25) and sends out on the corresponding packet data network. GGSN Participates into the mobility management and Maintains the

location information of the mobile stations that are using the data protocols provided by that GGSN also collects charging information for billing purpose.

GPRS Channels

PRACH: Packet Random Access Channel, uplink, used to initiate uplink transfer

PPCH: Packet Paging Channel, downlink, BSC uses this to page the MS before downlink transmission

PAGCH: Packet Access Grant Channel, downlink, resource assignments are sent on this channel

PDTCH: Packet Data Traffic Channel, up & downlink, used to send data packets

PACCH: Packet Associated Control Channel, up & downlink, used to convey signaling along with PDTCH

Mobility Management

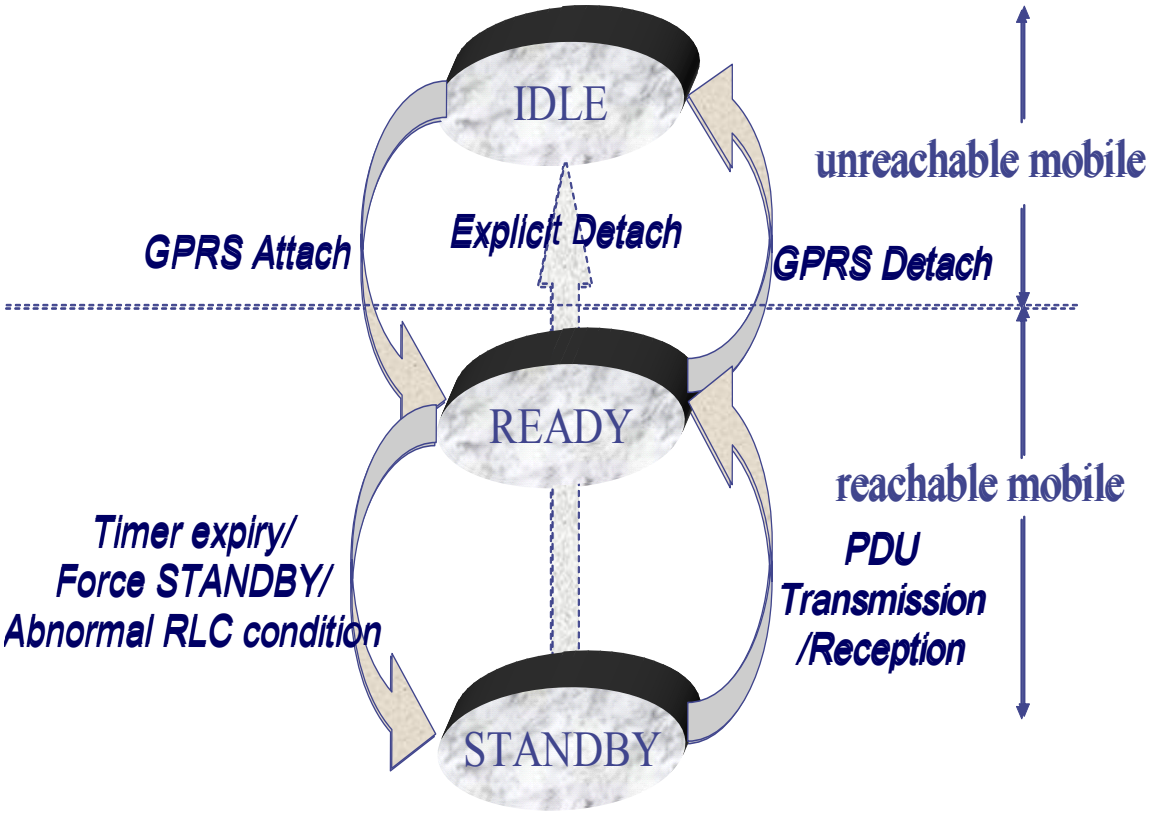


Fig. 2.21 GPRS Mobility Management

IDLE State: GPRS MS is unreachable - MS may receive PTM-M message

READY state: MS can send and receive PDP PDU, and receive PTM-P and PTM-G data. A timer monitors the ready state and upon its expiry, the MS is put on standby.

STANDBY State: MS is attached to GPRS MM. - MS and SGSN have established MM contexts. MS can receive PTM-M and PTM-G data (i.e. can receive paging message). PTP data reception and transmission, and PTM-G data transmission are not possible.

Packet transfer in GPRS

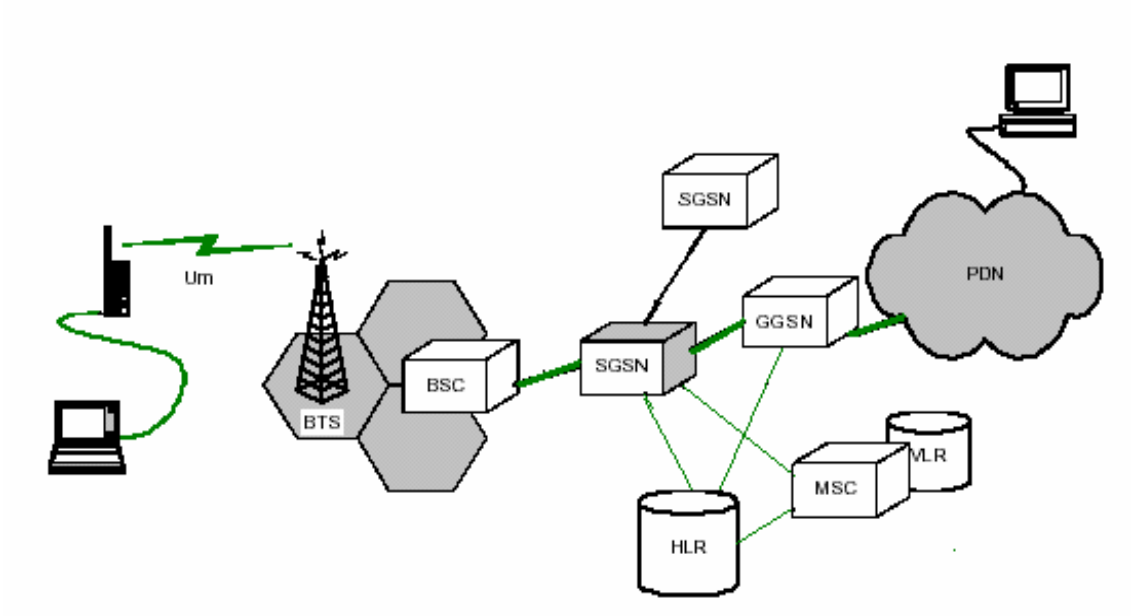


Fig. 2.22 Packet transfer in GPRS

- **GPRS – Data Connection phases**

  GPRS data connection starts with Attach and ends with Detach. Attach is the phase when the mobile informs the network of its intention to create a data connection. At conclusion of Attach, SGSN is ready to set up data services on behalf of the mobile user. Detach is the phase when mobile terminates the connection.

- **GPRS – Mobile Attach Scenario**

  Mobile sends Attach message. SGSN contacts HLR to verify if the user is permitted to use the service. After authentication, SGSN send back Attach Accepted together with a TLLI (Temporary Logical Link Identity). A database in SGSN is now populated with mobile identity and TLLI. TLLI is used by logical link controller in the SGSN.

- **GPRS – Setting Up Packet Data**

  After attach the mobile is known by SGSN and have an identity there, but it is not known to the external network. First it needs to create an identity for itself by performing a procedure called PDP Context Activation. PDP is Packet Data Protocol, which could be IP or x.25 protocol.

- **PDP Context Activation**

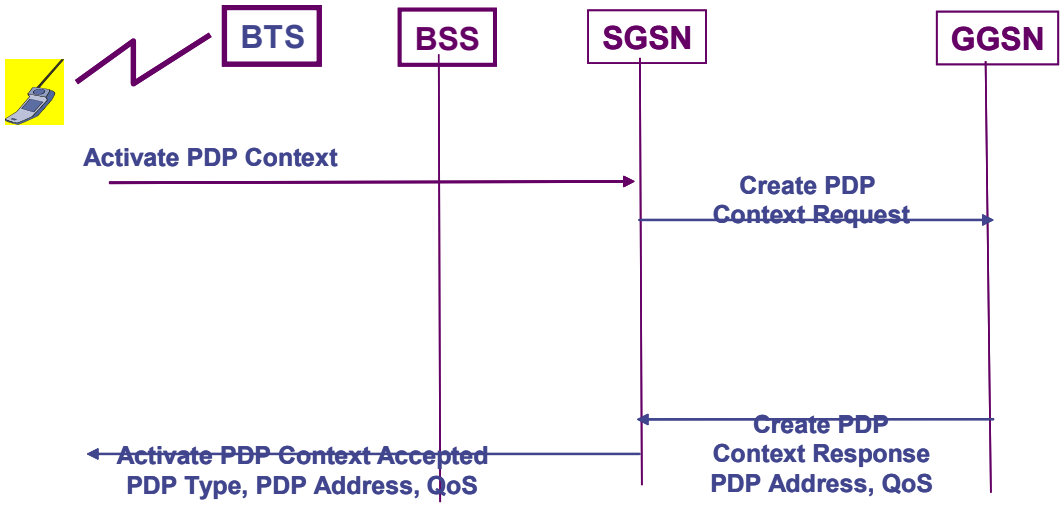


Fig. 2.23 PDP Context Activation in GPRS

Mobile requests PDP Context Activation. Based on the information provided, SGSN determines which GGSN to connect to. The GGSN should be capable to support the PDP requested by mobile. GGSN updates its data base and assign to SGSN. SGSN updates its data base with the GGSN address. It then send PDP Context Activation Accepted message to mobile.

Actually Sending Data

After PDP Context Activation the mobile is known to the external packet network (PDN). When SGSN receives data from mobile, it looks up its database and relates the TLLI to NSAPI. SGSN pad the IP packet and replace the destination address with GGSN IP address. Packets are then sent to GGSN with SGSN as sender. At GGSN, the additional information is removed to get the original packet. The packet can now be routed to its intended destination.

Enhanced Data Rates for Global Evolution – EDGE (2.5G and 3G Bridge)

Enhanced Data rates for Global Evolution (EDGE) is a radio based high-speed mobile data standard that allows data transmission speeds of 384 KBPS to be achieved when all eight timeslots are used. EDGE was formerly called GSM384, and is also recognized as 'UWC-136' under the ITU's specifications for IMT-2000. It was initially developed for mobile network operators who failed to win spectrum for third generation networks, and is a cost-efficient way of migrating to full-blown 3G services. It gives incumbent GSM operators the opportunity to offer data services at speeds that are near to those available on UMTS networks.

EDGE does not change much of the core network, however, which still uses GPRS/GSM. Rather, it concentrates on improving the capacity and efficiency over the air interface by introducing a more advanced coding scheme where every time slot can transport more data. In addition, it adapts this coding to the current conditions, which means that the speed will be higher when the radio reception is good. Implementation of EDGE by network operators has been designed to be simple, with only the addition of one extra EDGE transceiver unit to each cell. With most vendors, it is envisaged that

software upgrades to the BSCs and Base Stations can be carried out remotely. The new EDGE capable transceiver can also handle standard GSM traffic and automatically switches to EDGE mode when needed. 'EDGE-capable' terminals are also needed, since existing GSM terminals do not support new modulation techniques, and need to be upgraded to use EDGE network functionality.

EDGE can provide an evolutionary migration path from GPRS to UMTS by more expeditiously implementing the changes in modulation that are necessary for implementing UMTS later. The main idea behind EDGE is to squeeze out even higher data rates on the current 200 kHz GSM radio carrier, by changing the type of modulation used, whilst still working with current circuit (and packet) switches. In addition, the TDMA industry association, the "Universal Wireless Communications Corporation", has introduced what it calls EDGE Compact. This is an even more spectrum-efficient version of EDGE that will support the 384 KBPS mandated packet data rates, whilst requiring only minimum spectral clearing. In fact, as a result of this, EDGE has been renamed Enhanced Data Rates for GSM and TDMA Evolution.

The EDGE technology enhancements are meant to improve average and peak bit rates, latency, service coverage, and spectrum efficiency.
Box B (Item I) shows the targets used in the standardization. The first objective, increased spectrum efficiency, mainly benefits operators. In many urban areas, the existing frequency spectrum is being used to the maximum extent. However, by enhancing spectrum efficiency (that is, improved ability to withstand greater levels of interference) operators can increase traffic volumes without compromising quality. Best-effort services, such as web browsing and file downloads, typically benefit from increased peak

and mean bit rates. Depending on the degree of user interactivity, these services might also considerably benefit from reduced latency. Conversational services, such as voice over IP (VoIP) and enhanced Push to talk over Cellular (PoC), as well as online gaming services typically benefit from (or might even require) reduced latency and faster access.

All services (voice as well as packet-data) stand to benefit from improved coverage and from having terminals that are always connected to the most appropriate base station. Most services can benefit from faster initial response from the network. This is especially
true for conversational services and applications with limited system interactivity prior to uploading or downloading application data (for example, WAP, MMS and FTP). Although not presently pursued in 3GPP, solutions have been proposed that would decrease access time (when the mobile terminal is known in the packet control unit, PCU) to less than 500ms. Given that the installed base of GSM/EDGE equipment is very large, Ericsson has tried to minimize the effects of the proposed technology enhancements on base station hardware. As a consequence, the proposed solutions have no impact on transceiver units and other base station hardware. What is more, they assume the same (current) network architecture in following figure. In general, only radio network software and terminals will need to be updated.

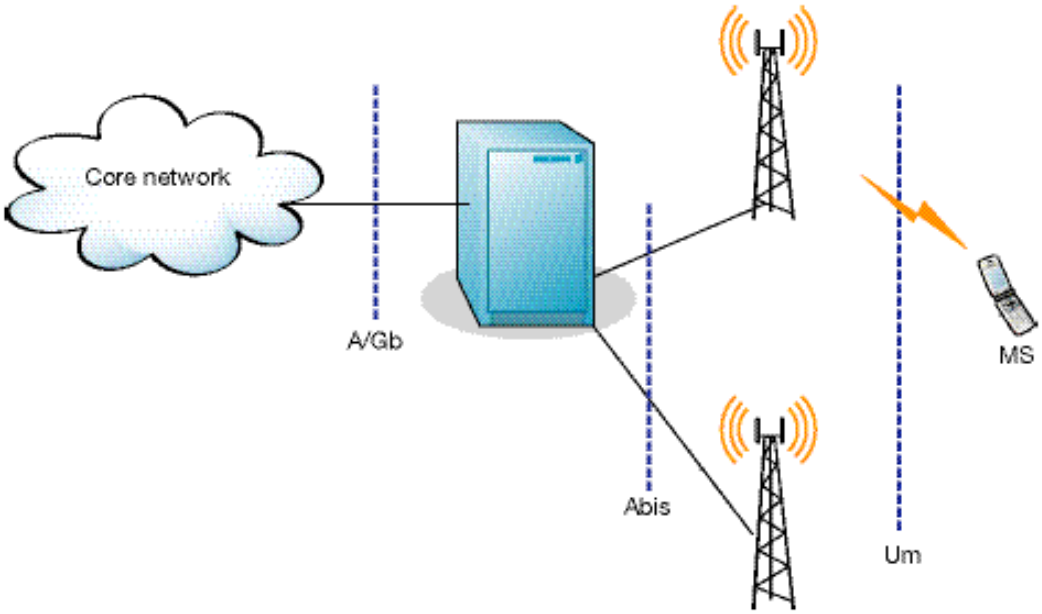


Fig. 2.24 EDGE receive signal through 2 antennas – 1

Dual-antenna terminals

A challenge associated with radio communication is that the strength of received radio signals varies rapidly relative to the position of the transmitter, the receiver, and other objects that scatter signals. This phenomenon, known as fading, can make a signal too weak to be captured. One other challenge is that other transmitters (terminals or base stations) in the vicinity can cause interference. Various techniques, such as channel coding, frequency hopping, and selective retransmission schemes, are used to combat fading and interference. Dual-receive-antenna systems are an efficient weapon against fading. To date, however, these have only been used on base station receivers.

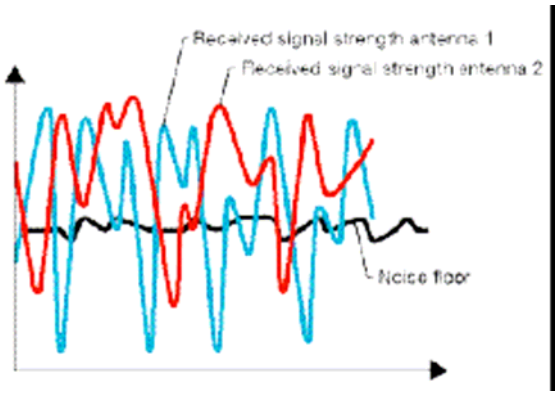


Fig. 2.25 EDGE receive signal through 2 antennas – 2

Above shows how two antennas mounted on a terminal, separated in space, polarization, or both, can receive two signals of the same transmission with different fading characteristics. This increases the probability that at least one of the signals will be strong enough (with some margin above the receiver noise floor) to be captured. Moreover, by combining two signals, one can sometimes capture a transmission that would otherwise have been altogether too weak. Dual-antenna solutions can also be used to efficiently handle interference. Obviously, the desired signal as well as all other received interference is subject to fading on the two antennas. But by combining the signals, one can cancel out interference by taking into account the instantaneous attenuation of the different signals due to fading (denoted a, b, c and d, in following figure).

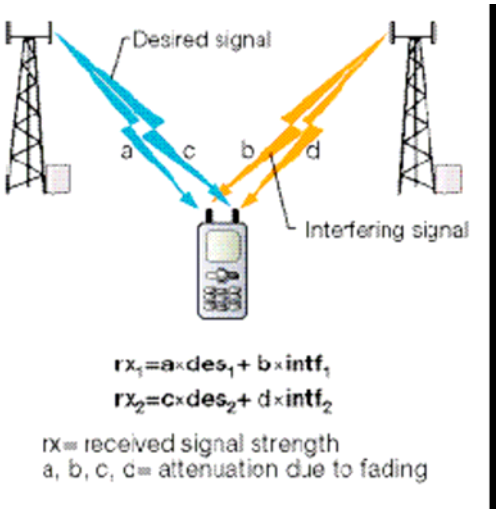


Fig. 2.26 EDGE Transmissions

This technique is known as interference cancellation. Experiments and computer simulations show that dual-antenna solutions in GSM terminals yield substantial improvement. In situations with limited coverage (that is, when the signal is too weak to be received correctly), dual-antenna terminals can cope with signal levels 6dB below (or one-fourth) that of single-antenna terminals. Moreover, dual-antenna terminals can handle almost 10dB (or ten times) more interference.

Multicarrier EDGE

The GSM radio interface is based on time division multiple accesses (TDMA) with 200 kHz carrier bandwidth. To increase bit rates, today's GPRS and EDGE terminals can use multiple timeslots for transmission, reception, or both (Figure 5, left). The GSM standard allows for up to eight timeslots in each direction (uplink and downlink), giving a theoretical peak bit rate of close to 480kbps. However, from a design and complexity point of view, it is best to avoid simultaneous transmission and reception. Therefore, in practice, today's terminals typically receive on a maximum of five timeslots because they must also transmit (on at least one timeslot) as well as measure the signal strength of neighboring cells. The actual number of timeslots a terminal uses for transmission is also limited. To increase bit rates, one can introduce multiple carriers for the downlink and uplink. This straightforward enhancement increases peak and mean bit rates in proportion to the number of carriers employed as shown in below figure.

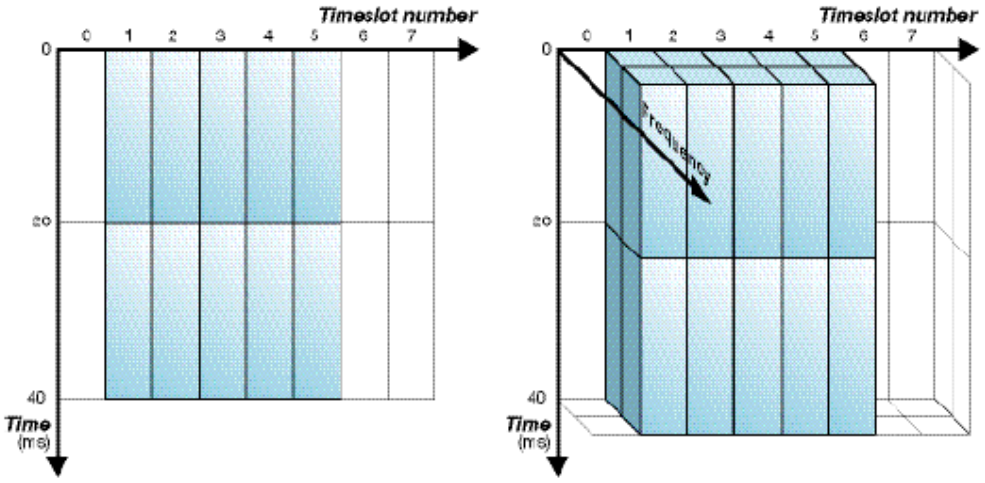


Fig. 2.27 Multicarrier EDGE

For example, given four carriers with eight timeslots each, the peak bit rate would be close to 2Mbps. The limiting factor in this case is the complexity and cost of the terminal, which must have either multiple transmitters and receivers or a wideband transmitter and receiver. The use of multiple carriers has only a minor impact on base transceiver stations.

Reduced Transmission Time Interval

Latency has a major influence on user experience. In particular, conversational services, such as VoIP and video telephony, require low latency. Other services that benefit from low delay are gaming and applications with extensive handshaking, such as e-mail. It is difficult to substantially improve latency without reducing the transmission time interval (TTI). The roundtrip time (RTT) in advanced GSM/EDGE networks with an Ericsson base station subsystem (BSS) is 150ms. This figure includes network delays but not retransmissions over the radio interface. Radio blocks are

transmitted over four consecutive bursts on one timeslot using a 20ms TTI.

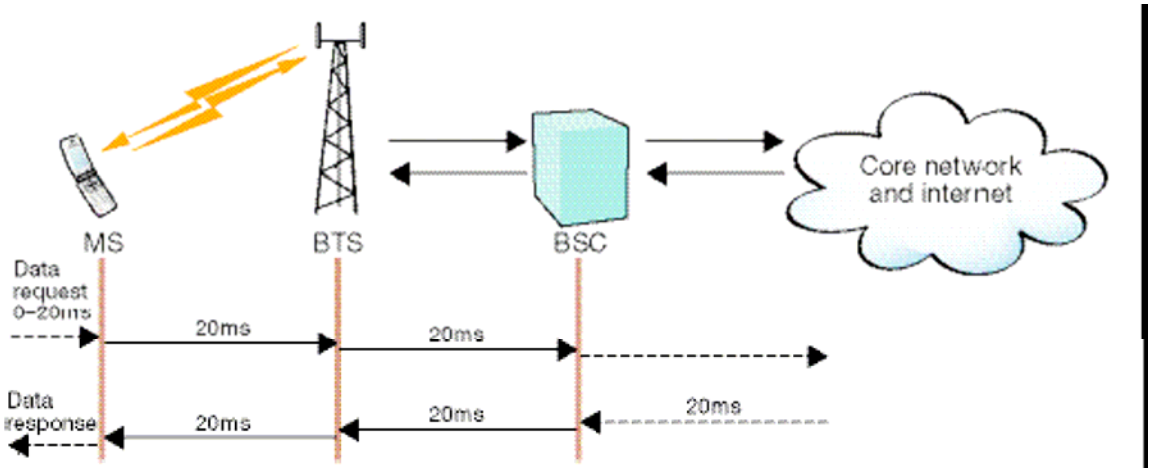


Fig. 2.28 EDGE data flow with a 20ms TTI

Above figure illustrates the data flow with a 20ms TTI. Reducing the TTI improves latency substantially and immediately. To reduce TTI, one can either use fewer than four bursts (smaller radio blocks) or transmit all four bursts on more than one timeslot (for example, parallel timeslots on two carriers). Ericsson estimates that reducing the TTI from 20ms to 10ms will reduce the roundtrip time from 150ms to 100ms.

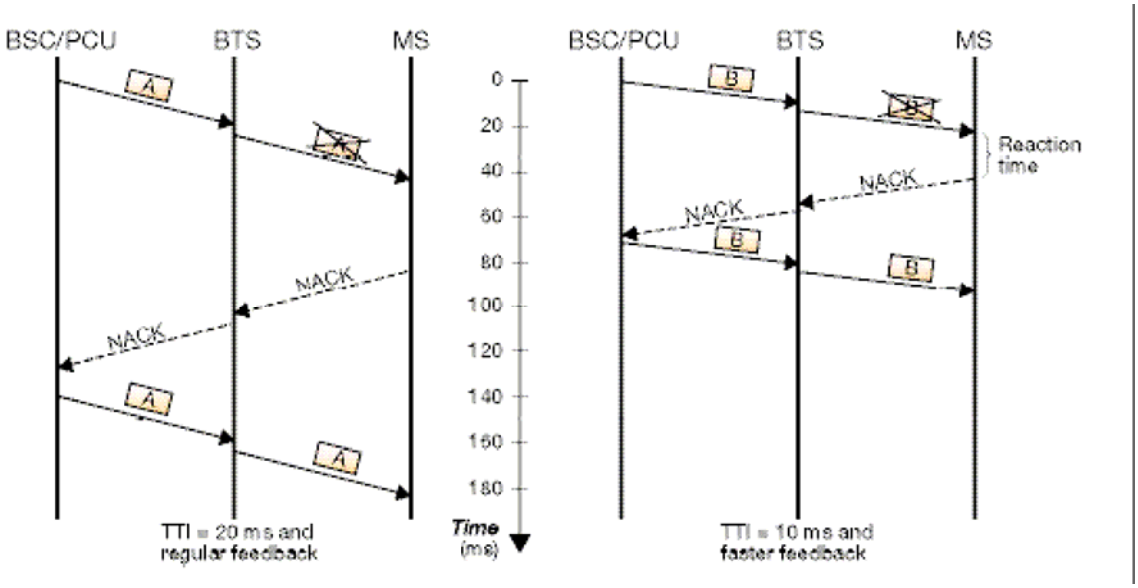


Fig. 2.29 Reduced TTI and faster feedback enhancements

Example of transfer using reduced TTI and faster feedback enhancements.

2.5G Technologies

- General Packet Radio Service (GPRS)
- Enhanced Data Rates for Global Evolution (EDGE)
- CDMA2000™, 1xRTT
- Evolution Data Only (1xEVDO)
- Evolution Data and Voice (1xEVDV)

The 2.5G shown the path for 3G

The rapid and efficient deployment of new wireless data and Internet services has emerged as a critical priority for communications equipment manufacturers. Network components that enable wireless data services are fundamental to the next-generation network infrastructure. Wireless data services are expected to see the same explosive growth in demand that Internet services and wireless voice services have seen in recent years. Third Generation (3G) mobile devices and services will transform wireless communications into on-line, real-time connectivity. 3G wireless technologies will allow an individual to have immediate access to location-specific services that offer information on demand. So as technology and application demand is grown from simple internet application usages to multimedia base applications and geographical data centric application the interchange of data speed need more

fuel which shown the new generation path to the wireless technology from 2.5G to 3G.

2.1.4 Wideband Digital Cellular Systems (3G)

Telecommunications service providers and network operators are embracing the recently adopted global third generation (3G) wireless standards in order to address emerging user demands and to provide new services. The concept of 3G wireless technology represents a shift from voice-centric services to multimedia-oriented (voice, data, video, fax) services. In addition, heavy demand for remote access to personalized data is fueling development of applications, such as the Wireless Application Protocol (WAP) and multimedia management, to complement the 3G protocols. Complementary standards, such as Bluetooth, will enable interoperability between a mobile terminal (phone, PDA etc.) and other electronic devices, such as a laptop/desktop and peripherals, providing added convenience to the consumer and allowing for the synchronization and uploading of information at all times. According to Lehman Brothers, approximately 50 percent of current voice services subscribers are expected to use wireless data services by 2007, instead of 25 percent as previously forecast. Lehman Brothers further predicts that, within seven years, 18 percent of cellular revenues and 21 percent of PCS (personal communications services) revenue will come from wireless data services. Cellular subscriptions are forecast to exceed one billion by 2003, compared with the 306 million that was forecast at the end of 1998, representing a compound annual growth of 29 percent.

Demand for voice services has traditionally been a market driver. However, today, demand for data services has emerged as an equally significant market driver. After many years of stasis, the

telecommunications industry is undergoing revolutionary changes due to the impact of increased demand for data services on wire line and wireless networks. Up until recently, data traffic over mobile networks remained low at around 2% due to the bandwidth limitations of the present second-generation (2G) wireless networks. Today, new technologies are quickly emerging that will optimize the transport of data services and offer higher bandwidth in a mobile environment. As a case in point, the increased use of the Internet as an acceptable source for information distribution and retrieval, in conjunction with the increased demand for global mobility has created a need for 3G wireless communications protocols. The third generation of mobile communications will greatly enhance the implementation of sophisticated wireless applications. Users will be able to utilize personal, location-based wireless information and interactive services. Also, many companies and corporations are restructuring their business processes to be able to fully exploit the opportunities provided by the emerging new wireless data services. Many advanced wireless services are already available today, and the introduction of 3G wireless technologies will add to their ubiquity.

3G wireless technology represents the convergence of various 2G wireless telecommunications systems into a single global system that includes both terrestrial and satellite components. One of the most important aspects of 3G wireless technology is its ability to unify existing cellular standards, such as CDMA, GSM, and TDMA, under one umbrella. The following three air interface modes accomplish this result: wideband CDMA, CDMA2000 and the Universal Wireless Communication (UWC-136) interfaces. Wideband CDMA (W-CDMA) is compatible with the current 2G GSM networks prevalent in Europe and parts of Asia. W-CDMA will require bandwidth of between 5Mhz and 10 MHz, making it a suitable

platform for higher capacity applications. It can be overlaid onto existing GSM, TDMA (IS-36) and IS95 networks. Subscribers are likely to access 3G wireless services initially via dual band terminal devices. W-CDMA networks will be used for high-capacity applications and 2G digital wireless systems will be used for voice calls. The second radio interface is CDMA2000 which is backward compatible with the second generation CDMA IS-95 standard predominantly used in US. The third radio interface, Universal Wireless Communications – UWC-136, also called IS-136HS, was proposed by the TIA and designed to comply with ANSI-136, the North American TDMA standard.

3G wireless networks consist of a Radio Access Network (RAN) and a core network. The core network consists of a packet-switched domain, which includes 3G SGSNs and GGSNs, which provide the same functionality that they provide in a GPRS system, and a circuit-switched domain, which includes 3G MSC for switching of voice calls. Charging for services and access is done through the Charging Gateway Function (CGF), which is also part of the core network. RAN functionality is independent from the core network functionality. The access network provides a core network technology independent access for mobile terminals to different types of core networks and network services. Either core network domain can access any appropriate RAN service; e.g. it should be possible to access a "speech" radio access bearer from the packet switched domain.

The Radio Access Network consists of new network elements, known as Node B and Radio Network Controllers (RNCs). Node B is comparable to the Base Transceiver Station in 2G wireless networks. RNC replaces the Base Station Controller. It provides the radio resource management, handover control and support for the

connections to circuit-switched and packet-switched domains. The interconnection of the network elements in RAN and between RAN and core network is over Iub, Iur and Iu interfaces based on ATM as a layer 2 switching technology. Data services run from the terminal device over IP, which in turn uses ATM as a reliable transport with QoS. Voice is embedded into ATM from the edge of the network (Node B) and is transported over ATM out of the RNC. The Iu interface is split into 2 parts: circuit switched and packet-switched. The Iu interface is based on ATM with voice traffic embedded on virtual circuits using AAL2 technology and IP-over-ATM for data traffic using AAL5 technology. These traffic types are switched independently to either 3G SGSN for data or 3G MSC for voice.

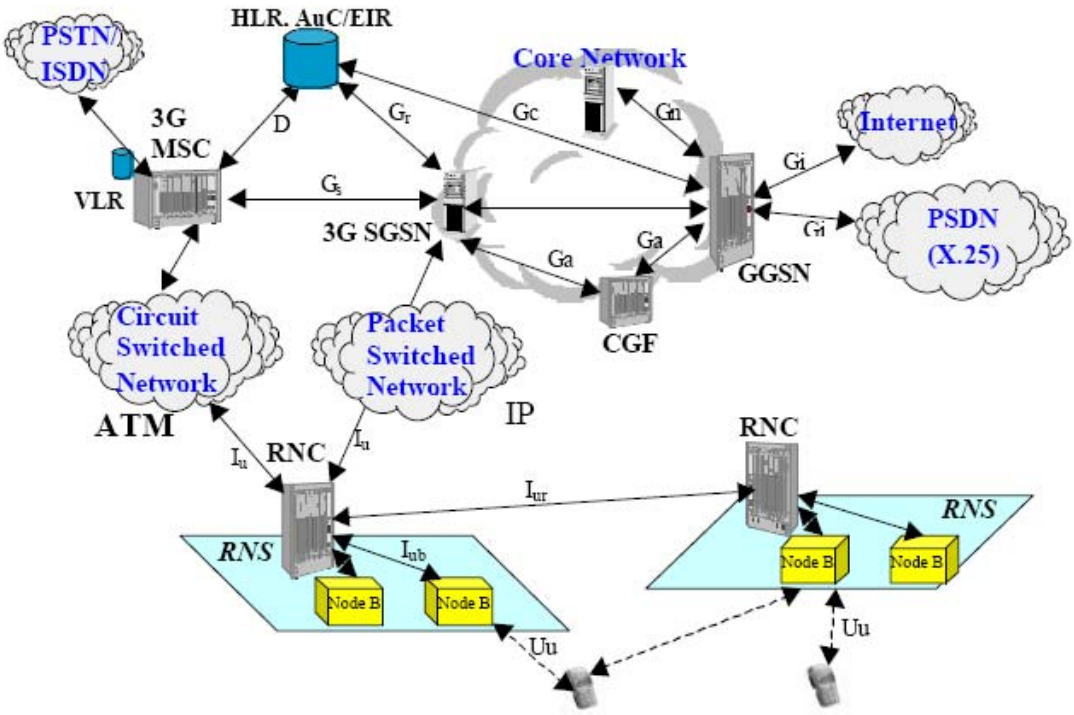


Fig. 2.30 3G wireless network architecture

The following is a brief description of each protocol layer in a 3G wireless network infrastructure:

- **Global Mobility Management (GMM):** protocol that includes attach, detach, security, and routing area update functionality.
- **Node B Application Part (NBAP):** provides procedures for paging distribution, broadcast system information and management of dedicated and logical resources.
- **Packet Data Convergence Protocol (PDCP):** maps higher level characteristics onto the characteristics of the underlying radio-interface protocols. PDCP also provides protocol transparency for higher layer protocols.
- **Radio Link Control (RLC):** provides a logical link control over the radio interface.
- **Medium Access Control (MAC):** controls the access signaling (request and grant) procedures for the radio channel.
- **Radio resource Control (RRC):** manages the allocation and maintenance of radio communication paths.
- **Radio Access Network Application Protocol (RANAP):** encapsulates higher layer signaling. Manages the signaling and GTP connections between RNC and 3G-SGSN, and signaling and circuit-switched connections between RNC and 3G MSC.
- **Radio Network Service Application Part (RNSAP):** provides the communication between RNCs.
- **GPRS Tunnel Protocol (GTP):** protocol that tunnels the protocol data units through the IP backbone by adding routing information. GTP operates on top of TCP/UDP over IP.
- **Mobile Application Part (MAP):** supports signaling between SGSN/GGSN and HLR/AuC/EIR.

- **AAL2 Signaling (Q.2630.1, Q.2150.1, Q.2150.2, AAL2 SSSAR, and AAL2 CPS):** protocols suite used to transfer voice over ATM backbone using ATM adaptation layer 2.
- **Sigtran (SCTP, M3UA):** protocols suite used to transfer SCN signaling protocols over IP network.

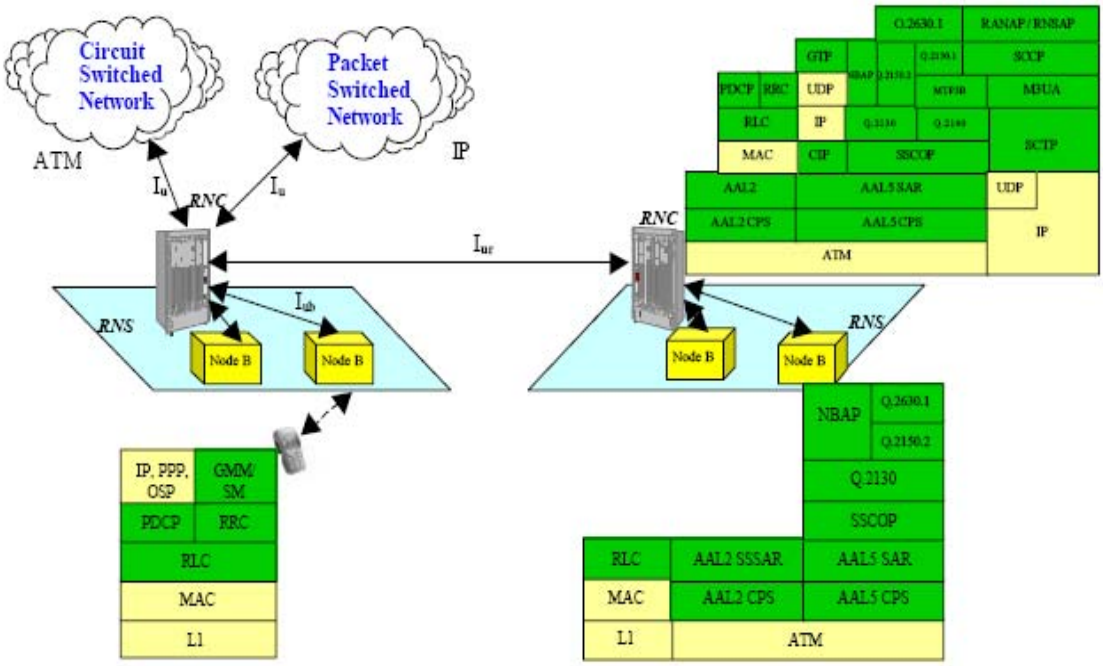


Fig. 2.31 Protocols used in Node B, RNC and mobile handsets

The implementation of 3G wireless systems raises several critical issues, such as the successful backward compatibility to air interfaces as well as to deployed infrastructures.

Interworking with 2G and 2G+ Wireless Networks

The existence of legacy networks in most regions of the world highlights the challenge that communications equipment manufacturers face when implementing next-generation wireless technology. Compatibility and interworking between the new 3G

wireless systems and the old legacy networks must be achieved in order to ensure the acceptance of new 3G wireless technology by service providers and end-users. The existing core technology used in mobile networks is based on traditional circuit-switched technology for delivery of voice services. However, this traditional technology is inefficient for the delivery of multimedia services. The core switches for next-generation of mobile networks will be based on packet-switched technology which is better suited for data and multimedia services. Second generation GSM networks consist of BTS, BSC, MSC/VLR and HLR/AuC/EIR network elements. The interfaces between BTS, BSC and MSC/VLR elements are circuit-switched PCM. GPRS technology adds a parallel packet-switched core network. The 2G+ network consists of BSC with packet interfaces to SGSN, GGSN, HLR/AuC/EIR. The interfaces between BSC and SGSN network elements are either Frame Relay and/or ATM so as to provide reliable transport with Quality of Service (QoS).

3G wireless technologies introduce new Radio Access Network (RAN) consisting of Node B and RNC network elements. The 3G Core Network consists of the same entities as GSM and GPRS: 3G MSC/VLR, GMSC, HLR/AuC/EIR, 3G-SGSN, and GGSN. IP technology is used end-to-end for multimedia applications and ATM technology is used to provide reliable transport with QoS. 3G wireless solutions allow for the possibility of having an integrated network for circuit-switched and packet-switched services by utilizing ATM technology. The BSC may evolve into an RNC by using add-on cards or additional hardware that is co-located. The carrier frequency (5Mhz) and the bands (2.5 to 5Ghz) are different for 3G wireless technology compared to 2G/2G+ wireless technology. Evolution of BSC to RNC requires support for new protocols such as PDCP, RRC, RANAP, RNSAP and NBAP. Therefore, BTS' evolution

into Node B may prove to be difficult and may represent significant capital expenditure on the part of network operators. MSC evolution depends on the selection of a fixed network to carry the requested services. If an ATM network is chosen, then ATM protocols will have to be supported in 3G MSC along with interworking between ATM and existing PSTN/ISDN networks. The evolution of SGSN and GGSN to 3G nodes is relatively easier. Enhancements to GTP protocol and support for new RANAP protocol are necessary to support 3G wireless systems. ATM protocols need to be incorporated to transport the services. The HLR databases evolve into 3G-HLR by adding 3G wireless user profiles. The VLR database must also be updated accordingly. The EIR database needs to change to accommodate new equipment that will be deployed for 3G wireless systems. Finally, global roaming requires compatibility to existing deployment and graceful fallback to an available level when requested services are not available in the region. Towards this end, the Operator Harmonization Group (OHG) is working closely with 3G Partnership Projects (3GPP and 3GPP2) to come up with global standards for 3G wireless protocols.

3G Wireless Technologies

- Wideband Code Division Multiple Access (WCDMA)
- Code Division Multiple Access 2000 (CDMA2000)
- Time Division Synchronous CDMA (TD-SCDMA)

2.1.5 Comparisons of Advance Wireless Technologies (2G, 2.5G, 3G)

Services Comparison

Services	2G	2.5G	3G
e-mail	Short Messages (SMS)	Text-based with small Attachments	Full attachments
Instant Messaging	Short Messages (SMS)	Text-based	With Audio/Video Clips
Web Browsing	Short Text Screens	100KB Web (text + image) page takes approx. 30 seconds to download	100KB Web page takes approx. 2 seconds to download
Streaming Audio/Video	No	Short clips	Yes
VoIP	No	Limited	Yes
File Transfer	No	500KB document takes approx. 2 min to download	500KB document takes approx. 10 sec to download
Access to Corporate Applications	Very limited	Text-based	Yes
Access to Corporate Internet, database	Very limited	Text-based	Yes
Locations based Services	No	Limited	Yes

Applications Comparison

Period	Technology Introduce	Internal External Applications
Up to 2000	2G	• Telephone • Email • SMS • Digital Text Delivery
2001 to 2002	2.5G	• Mobile Banking • Voicemail, Web • Mobile Audio Player • Digital Newspaper Publishing • Digital Audio Delivery • Mobile Radio, Karaoke • Push Marketing/ Targeted programs • Location-based services • Mobile coupons
2003 onward	3G	• Mobile videoconferencing • Video Phone/Mail • Remote Medical Diagnosis and Education • Mobile TV/Video Player • Advanced Car Navigation/ City Guides • Digital Catalog Shopping • Digital Audio/Video Delivery • Collaborative B2B Applications

2.1.6 Future Enhancement in Wireless Technologies

Voice was the driver for second-generation mobile and has been a considerable success. Today, video and TV services are driving forward third generation (3G) deployment. And in the future, low cost, high speed data will drive forward the fourth generation (4G)

as short-range communication emerges. Service and application ubiquity, with a high degree of personalization and synchronization between various user appliances, will be another driver. At the same time, it is probable that the radio access network will evolve from a centralized architecture to a distributed one.

The evolution from 3G to 4G will be driven by services that offer better quality (e.g. video and sound) thanks to greater bandwidth, more sophistication in the association of a large quantity of information, and improved personalization. Convergence with other network (enterprise, fixed) services will come about through the high session data rate. It will require an always-on connection and a revenue model based on a fixed monthly fee. The impact on network capacity is expected to be significant. Machine-to-machine transmission will involve two basic equipment types: sensors (which measure parameters) and tags (which are generally read/write equipment). It is expected that users will require high data rates, similar to those on fixed networks, for data and streaming applications. Mobile terminal usage (laptops, Personal digital assistants, and handhelds) is expected to grow rapidly as they become more users friendly. Fluid high quality video and network reactivity are important user requirements. Key infrastructure design requirements include: fast response, high session rate, high capacity, low user charges, rapid return on investment for operators, investment that is in line with the growth in demand, and simple autonomous terminals. The infrastructure will be much more distributed than in current deployments, facilitating the introduction of a new source of local traffic: machine-to machine.

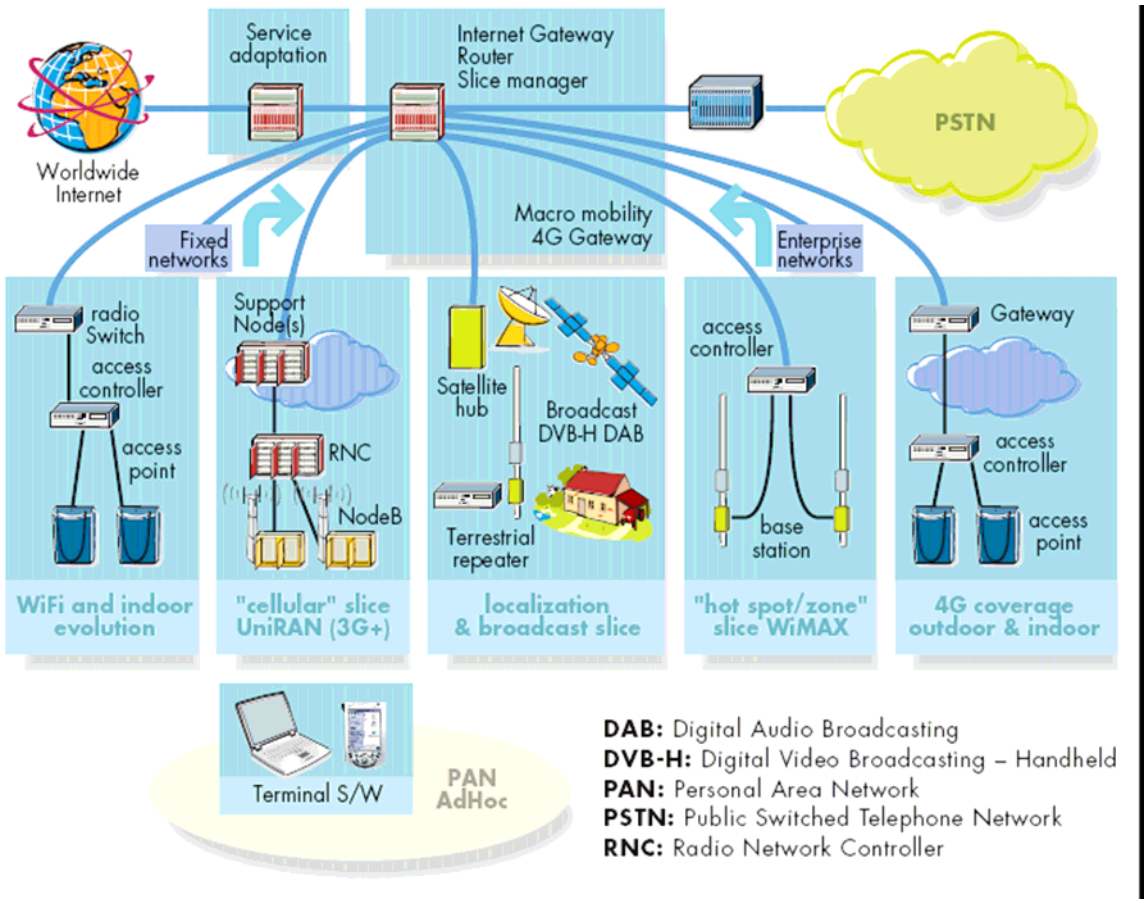


Fig. 2.32 (4G Wireless Technologies)

Many technologies are competing on the road to 4G, as can be seen in above figure. Three paths are possible, even if they are more or less specialized. The first is the 3G-centric path, in which Code Division Multiple Access (CDMA) will be progressively pushed to the point at which terminal manufacturers will give up. When this point is reached, another technology will be needed to realize the required increases in capacity and data rates. The second path is the radio LAN one. Widespread deployment of WiFi is expected to start in 2005 for PCs, laptops and PDAs. In enterprises, voice may start to be carried by Voice over Wireless LAN (VoWLAN). However, it is not clear what the next successful technology will be. Reaching a consensus on a 200 Mbit/s (and more) technology will be a lengthy task, with too many proprietary solutions on offer. A third path is IEEE 802.16e and 802.20, which are simpler than 3G for the

equivalent performance. A core network evolution towards a broadband Next Generation Network (NGN) will facilitate the introduction of new access network technologies through standard access gateways, based on ETSI-TISPAN, ITU-T, 3GPP, China Communication Standards Association (CCSA) and other standards. How can an operator provide a large number of users with high session data rates using its existing infrastructure? At least two technologies are needed. The first (called "parent coverage") is dedicated to large coverage and real-time services. Legacy technologies, such as 2G/3G and their evolutions will be complemented by WiFi and WiMAX. A second set of technologies is needed to increase capacity, and can be designed without any constraints on coverage continuity. This is known as pico-cell coverage. Only the use of both technologies can achieve both targets (Figure 4). Handover between parent coverage and pico cell coverage is different from a classical roaming process, but similar to classical handover. Parent coverage can also be used as a back-up when service delivery in the pico cell becomes too difficult.

4G facilities Advance Applications

Communications services and applications involve messaging and other means of staying connected. These services and applications are important to all the user segments, especially the Mobile Professional segment. Communications services include short messaging service (SMS), e-mail, video conferencing, fax, and bulletin boards. Although some of these services are available in today's wireless systems, in future generations these services will be greatly enhanced. (Speed and reliability are the most notable enhancements planned for these services.)

Organizational services include personal digital assistant (PDA) capabilities, currency exchange based on user location, and other personal management applications (e.g., calendars, call management, and address books). Organizational services and applications are relevant to all the user segments but are geared primarily to the Income Brackets and Mobile Professional user segments. Entertainment services are viewed by service providers as having the greatest potential for immediate return on investment. Entertainment services may include streaming audio, streaming video, chat, photo trading, and gaming. In the Asian wireless market, where preliminary iterations of 3G are being deployed, entertainment services are generating substantial revenue. The user segment targeted for entertainment services is the Age segment. Another service generating much excitement in the industry is mobile commerce (M-Commerce). M-commerce is the ability for subscribers to purchase items (e.g., gas, food from vending machines, etc.) using a wireless device. For example, to purchase an item from a vending machine, users would dial a phone number or access code associated with the item (most likely marked on the vending machine) and the item would be dispensed. In this scheme, the vending machine would be connected to the public switched telephone network (PSTN) via a modem or other gateway-type device. The wireless service provider would pass the information to the vending company and the vending company would, in turn, pass the information to the vending machine to instruct it to dispense the item. The user's wireless service account would be billed for any items purchased, much like a credit card. This type of M-commerce is currently being tested and implemented (on a very limited basis) in select countries in Europe and Asia already having advanced, 2.5G wireless networks. M-commerce can be considered Information and/or an Organization type of service.

Push, Pull, and Location-Based Services

Push and pull services are services that rely on the network's ability to locate subscribers. In 4G, it is envisioned that networks will be able to pinpoint the exact location of subscribers, both indoors and out. This ability will make it possible for value-added functionality to be offered by service providers. Both push and pull services are further enhanced by user profiles. User profiles, established and updated by subscribers, assure that information to each user is truly customized. User profiles contain the subscriber's preferences (e.g. likes/dislikes, schedules, and formats) and permissions (i.e. who is allowed to know who and where they are). The user's profile would reside in a database maintained by the service provider. The user profile will be used by the serving network to push services to subscribers. For example, if a user likes a

Particular type of food, the network will see the preference in the user's profile and will push information regarding restaurants that serve that type of food in the general locale of the user. Similarly, the user will be able request this same information from the network (pull) if he or she chooses not to have this information pushed to the wireless device. The challenge with location-based services is not in the applications but in the implementation. For location services to be of any real value, the network must be able to determine the location of subscribers to a high degree of accuracy—perhaps to within a few feet. Current wireless networks do not have this capability. In today's networks, location can be determined by looking at the serving cells that are communicating with the user's handset. At best, this technique can be accurate to

within a few city blocks; not nearly the accuracy needed for 4G applications.

Current plans for 4G involve using Internet Protocol version 6 (IPv6) to route data packets to the handset. IPv6 has built-in location tracking that will enhance the network's ability to pinpoint a subscriber's location. Some have proposed applying global positioning system (GPS) capabilities in handsets to help locate subscribers. GPS, however, would be helpful only to a minor extent. GPS relies on the ability its receiver to "see" multiple satellites orbiting the Earth. If the receiver has no access to the sky (i.e., it is indoors), no location information can be provided. Another benefit to public safety that can be realized in the enhanced 4G environment is the ability to locate people in need of assistance. For example, if a user makes an emergency call from a wireless device and is unable to give an address or location to the emergency operator, the emergency operator can pinpoint the user's position via the wireless network's built-in functionality. This type of service will offer users peace of mind and will help the public safety community do its job more effectively. A push-based service that would aid public safety is the ability for the network to send users information, such as the location of the nearest police precinct, whenever the subscriber's wireless device registers on a new system. Another service that may be of interest to public safety is the ability for the network to push information regarding incidents (either emergency or non emergency, depending on the user's profile) in the area where the user is currently registered and located. This type of service may be very useful in situations where normal first responders cannot reach the incident as quickly as the user (e.g., in metropolitan areas where traffic gridlock impedes the first responders' ability to arrive on scene expeditiously, or a situation where an armed law enforcement officer, outside of his or

her normal jurisdiction, could respond to a call for help more quickly than a "local" officer could respond).

2.2 Information Delivery Medium

Mobile Commerce is implementation is possible with proper delivery medium to interchange business information from wireless devices to application server and vice versa application to wireless devices. The information is ever in the form of messaging alerts or business transactions.

2.2.1 Messaging Services

Short Message Service (SMS)

The Short Message Service (SMS) is the ability to send and receive text messages to and from mobile telephones, PDA, Palm and other Wireless devices. The text can comprise of words, numbers, an alphanumeric combination or a binary format for the transmission of simple graphical and audio information. The first short message was sent in December 1992 from a Personal Computer to a mobile phone on the Vodafone GSM network in UK. From then on, SMS became an accidental success that took nearly everyone in the mobile industry by surprise. Few people predicted that this difficult to use service would take off.

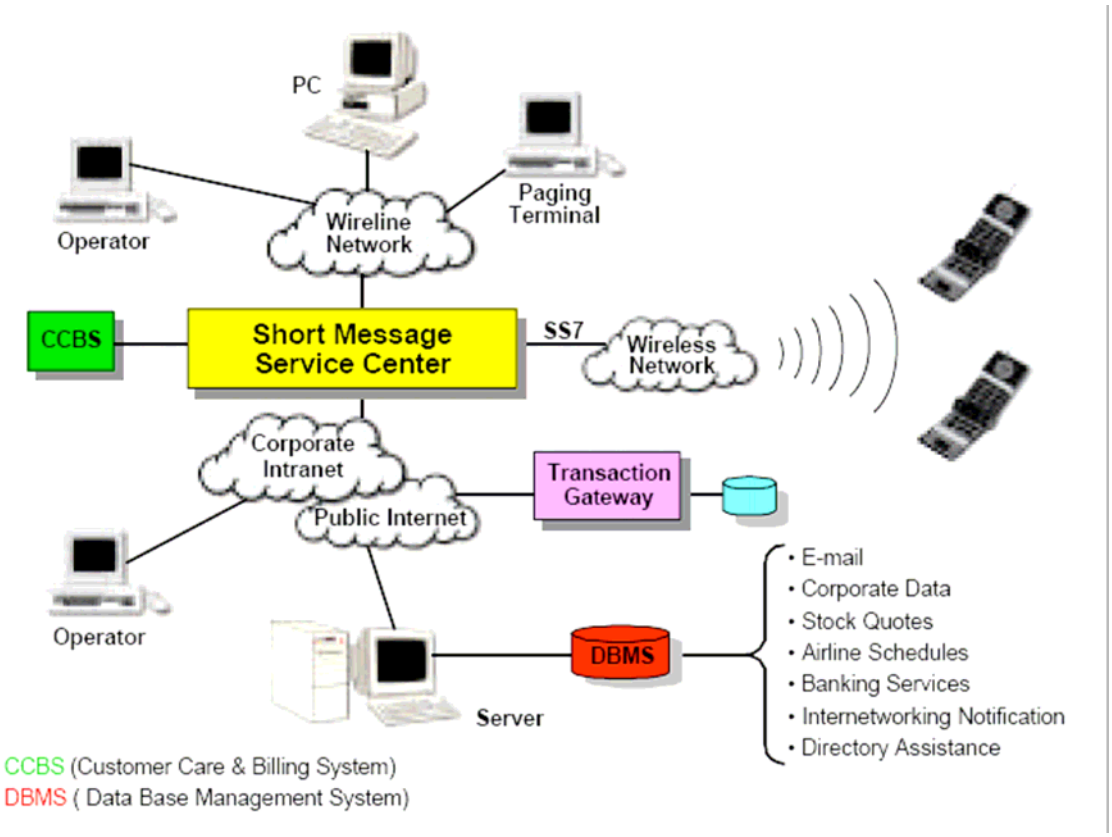


Fig. 2.33 SMS Network

The network elements are designed to provide guaranteed delivery of text messages to the destination. Temporary failures due to unavailable receiving stations are identified, and the short message is stored in the SMSC until the destination device becomes available. An active mobile handset is able to receive or submit a short message at any time, regardless of whether a voice or data call is in progress. SMS supports several input mechanisms that allow interconnection with different message sources and destinations (e.g., voice mail, web, e-mail). SMS is characterized by out-of-band packet delivery and low-bandwidth message transfer, which results in a highly efficient means for transmitting short bursts of data.

Short Message Data Structure

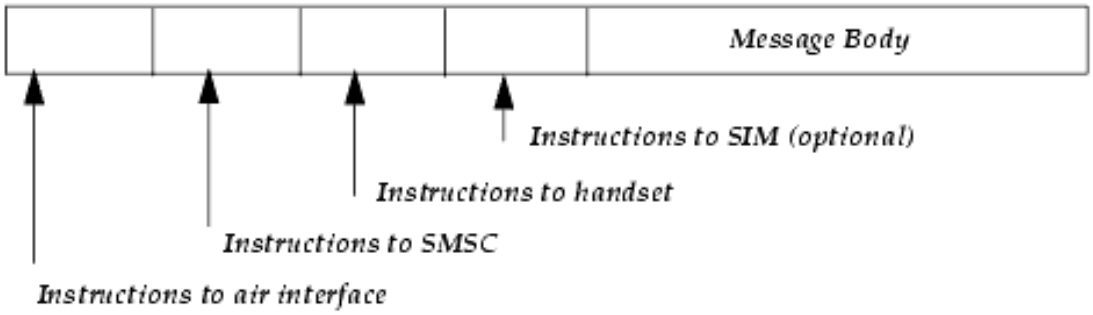


Fig. 2.34 Short Message Data Structure

A short message is formally known as a Protocol Data Unit (PDU) and comprises two parts - the header information and the short message text itself (known as the user data). This short message is sent to the SMS Center that looks at the details on the header and tries to send the message to the recipient using the type of postal service the sender specified. The header contains the following parameters:

SMSC Address: The address of the SMS Center to which the short message is to be sent.

Destination Address: The Destination Address field denotes the final recipient of the short message. This parameter is usually specified by the sender.

Originating Address: The address of the sender of the short message. Usually automatically appended to the short message itself so that the recipient can identify the sender.

Status Report Request: This parameter allows the short message sender to request confirmation that the short message has been delivered to its intended recipient.

Service Center Timestamp: In addition to the short message text itself and the Originating Address, the time and date that the SMS Center received the short message are usually also automatically appended to outbound short messages from the SMS Center.

Validity Period: Each short message submitted to the SMS Center is assigned a Validity Period, which sets the maximum time that the short message is retained in the SMS Center. Failure to successfully deliver the short message within the short message lifetime causes it to be marked for purge, with no further delivery attempts made. Setting specific short message Validity Periods is important for many SMS-based applications. Some SMS Centers can inform software applications as soon as a short message lifetime expires, allowing alternative, and secondary action to be taken. `All short messages have a message lifetime - those short messages that do not have a specific value when submitted are automatically assigned the default Validity Period for that mobile network. For example, some mobile network operators set a maximum short message lifetime of 72 hours (Vodafone, UK) or 48 hours (Vodafone D2, Germany), after which any short messages that haven't been delivered are deleted.

Date Coding Scheme: The Data Coding Scheme (DCS) parameter is used for several purposes, including the following:

- Indicate the form in which the short message text (user data) is encoded, be it the GSM 7-bit default alphabet, 16-bit text or binary.
- Specify short message classes, which tell the mobile phone how to deal with the short message. For example, the Data Coding Scheme flag is used to indicate whether to store the short message in the SimCard or memory, send it directly to

the display or to Terminal Equipment attached to the mobile phone.

- Allow a receiving Short Message Entity to display an icon associated with a short message, such as an email or voice mail icon.
- Indicate that a short message is compressed.

Protocol Identifier: Another flag that is used for a wide variety of purposes is the Protocol Identifier (PID). The PID determines how the short message should be handled by the receiving entity or the SMS Center. Uses of the Protocol Identifier include:

- Routing short messages to the correct outbound interface. This is useful when several interfaces share the same numbering plan (e.g. PSTN fax and voice). Use of the Protocol Identifier indicates to the SMS Center where to send the short message to maximize the likelihood that it is successfully delivered to its intended Destination Address.
- Routing by Protocol Identifier is, for example, used in the provision of SMS to Fax services, through which a mobile phone user can send a short message to a fax machine. The SMS Center recognizes that the Protocol Identifier indicates an SMS to Fax message and routes the short message to the module within the SMS Center that incorporates fax out dial, or an SMS to Fax platform resident outside the SMS Center itself.
- Indicating that a mobile phone receiving a short message should check to see if a short message of the same type is currently stored and if so replace it with the new one.

Reply Path: The Reply Path allows a user to indicate to the receiver that a reply to the short message is requested. When the recipient

chooses to reply to a short message, the SMSC Address from which the short message came is used instead of the SMSC Address stored on the Simcard. Additionally, the Originating Address from which the short message came is automatically used as the Destination Address. This feature was incorporated to indicate to the SMS Center that the initial sending entity should be charged for the reply rather than the replying entity. The advantage is that someone sending a message can receive a reply even if the recipient of the short message has not got an SMS Center number programmed into his or her Simcard. Many mobile phones allow a recipient to reply to a short message irrespective of the setting of the Reply Path parameter in the received short message. In such cases, the SMS Center and Originating Address translation described above is also applied.

Message Reference: An identifier (1- 255) which is incremented with each short message sent.

Message Length: Indicates the length of the short message.

Reject Duplicates: The Reject Duplicates parameter allows a sender to indicate to the SMS Center that a short message with the same Message Reference as one already stored in the SMS Center for the same Destination Address should be discarded and replaced by the new one.

SMS Commands: Some mobile phones allow the sender to send specific instructions to the SMS Center to carry out operations on previously submitted short messages. For example, different command types allow the user to inquire about the status of a short message or delete a short message that is waiting to be delivered.

Message Type Indicator: The Message Type Indicator parameter indicates whether a short message is for sending, receiving, is a status report (confirmation of delivery), or a specific command to the SMS Center such as an enquiry on a short message. A user does not normally have control over this parameter from the mobile phone keypad.

SMS Transmission

SMS is a service which is used to transmit text data from either MS to MS or Application server to MS. Mobile-originated and Mobile-terminated is two processes responsible to transmit SMS in the wireless network. When SMS is deliver from MS to MS the both process is comes in to the picture while in the case of Application server to MS delivery Mobile-terminated Process is required.

Mobile-Originated Short Message

The MS transfers the SM to the MSC. The MSC interrogates the VLR to verify that the message transfer does not violate the supplementary services invoked or the restrictions imposed. The MSC sends the short message to the SMSC using the forwardShortMessage operation. The SMSC delivers the short message to the SME. The SMSC acknowledges to the MSC the successful outcome of the forwardShortMessage operation. The MSC returns to the MS the outcome of the MO-SM operation. The steps are shown in below figure.

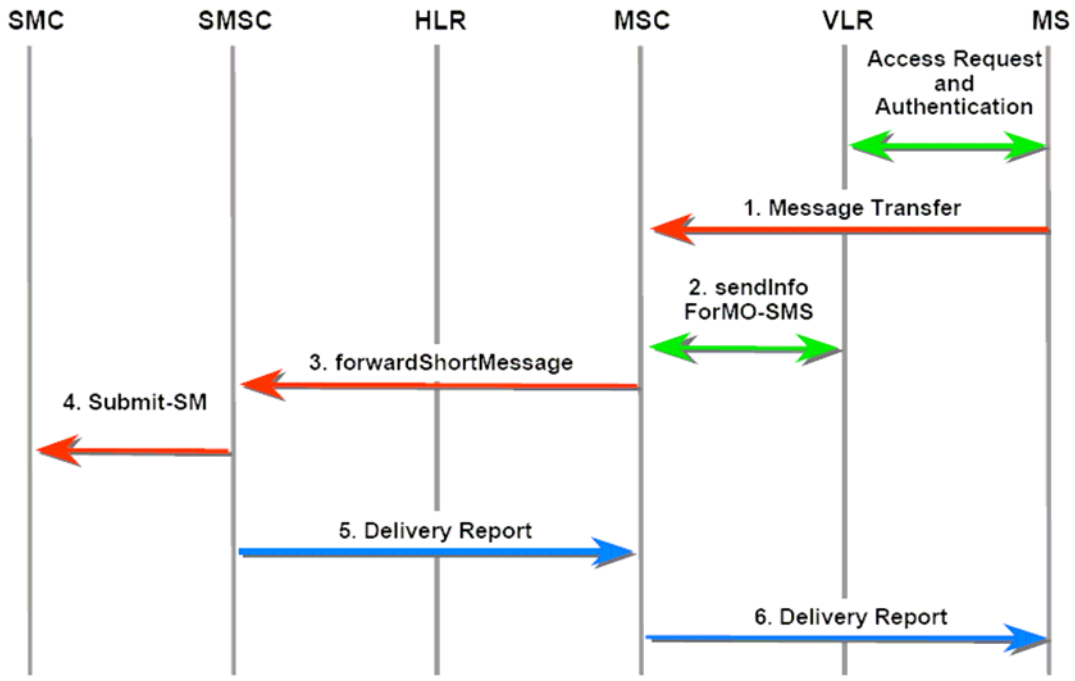


Fig. 2.35 Mobile-Originated Short Message

Mobile-Terminated Short Message

The short message is submitted from the SME to the SMSC. After completing its internal processing, the SMSC interrogates the HLR and receives the routing information for the mobile subscriber. The SMSC sends the short message to the MSC using the forwardShortMessage operation. The MSC retrieves the subscriber information from the VLR. This operation may include an authentication procedure. The MSC transfers the short message to the MS. The MSC returns to the SMSC the outcome of the forwardShortMessage operation. If requested by the SME, the SMSC returns a status report indicating delivery of the short message. The steps are shown in below figure.

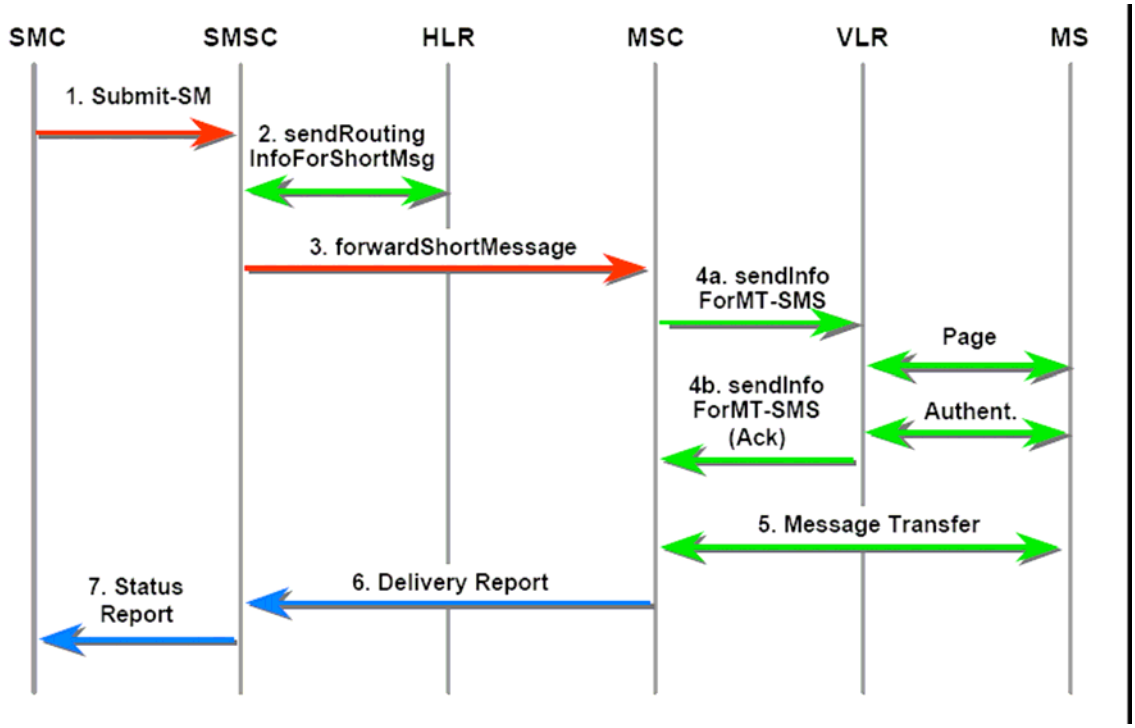


Fig. 2.36 Mobile-Terminated Short Message

SMS Applications & Services

Information Alerts: Travel updates, news alerts, stock alerts...
Customization Services: Logos & screen savers, ring tones, music...
Communities: Personal chat, dating, private consulting...
Entertainment: Quiz & games, SMS voting, jokes & cartoons...
Mobile Marketing: Direct marketing, special promotions...
M-Commerce: Bus tickets, tickets for movies, online purchases, pay-per-view, web-content...

Multimedia messaging service (MMS)

Multimedia messaging service (MMS) will allow users to express themselves more fully, making mobile messaging more creative and entertaining. The enhanced messaging service (EMS) that is now becoming available with sound, pictures and animations only hints at what we can come to expect from MMS. With MMS it will be

possible to send and receive rich, integrated content made up of video, digital audio, color images and animations. MMS is more than just messaging: it is a service environment that facilitates the creation of a new wave of interactive applications and services, such as maps, postcards, entertain content, business cards, business statistic information in graph view and many more where the multimedia content is involved. The push capabilities of MMS will also open up a new communication channel through which companies can send promotions and other information that customer's request.

As with SMS, MMS does not require a network mailbox, so users do not have to log on to receive messages. Each message is automatically pushed to the user's MMS enabled mobile device. Likewise, if the recipient's mobile device is switched off or temporarily out of coverage, the message is stored by the network until it can be safely delivered. Users can send, receive, reply to, delete and forward messages. Unlike SMS, however, virtually no limits are put on the size or the sophistication of MMS message content. What is more, MMS messages can be exchanged between MMS enabled mobile devices and Internet e-mail accounts.

The message elements available to users as part of MMS are dependent on the data capabilities of the wireless network and on the capabilities of the device. As mobile networks develop (third-generation), and new mobile devices are introduced, the range of messaging options will grow. The following message options are currently covered by the MMS standard. More will be added as the standard develops:

- Text: As with SMS and EMS, an MMS message can consist of plain text. EMS and MMS also enable text to be formatted using different fonts, sizes, and styles. The main difference

between formatted text in EMS and MMS is that MMS allows much greater amounts of text than SMS/EMS. In EMS, formatted text can be accompanied by simple pixel images or melodies. In MMS, the formatted text can be accompanied by photographic images, graphics, audio samples, and video sequences.

- Graphics: graphs, tables, charts, diagrams, maps, sketches, plans and layouts are just a few examples of the kind of graphics that MMS can handle. As location-based services become more prevalent, maps and sketches will have ever greater relevance to mobile users.
- Audio samples: MMS supports the addition of audio samples to messages. For example, users can exchange a favorite song, or they can use the mobile phone to record and send sound samples, including voice. MMS can also be used to send MP3 files or other high quality audio formats.
- Images: one of the most exciting attributes of MMS is the ability to send images. Using a mobile device with either a built-in or attached digital camera, users can take a snapshot, add some text, and send it as a digital postcard. Business users could record and send pictures of a construction project, or capture and store a new design concept for later review.
- Synchronized presentations: using the synchronized multimedia integration language (SMIL, an XML-based protocol), MMS enables Power Point style presentations (with integral audio and video) to be created on, and sent from/received by mobile devices. Using a simple media editor, users can incorporate audio and video along with still images and formatted text in multimedia presentations.
- Video: the ultimate extension of the MMS digital imaging capabilities will be video content. Users will be able to record a scene using a built-in digital camera and transmit the clip to

a recipient (initially, they will be able to exchange 30-second video clips).

- Streaming media: large video and sound content can be streamed using MMS without having to occupy memory in the phone. Although this seems like a contradiction since the basic principle of MMS is to store messages locally in the phone streaming technology is actually well suited for MMS. When the message is viewed in the phone, the content is not stored, but is streamed directly to it.

MMS Architecture

Below figure shows MMS architecture, which combines different networks and network types, and integrates already existing messaging systems in these networks. The MMS environment (MMSE) encompasses all necessary service elements for delivery, storage and notification. These can be located within one network or distributed across several networks or network types. The MMSE can comprise

- second- and third-generation networks
- second-generation networks with islands of third-generation coverage
- Roamed networks.

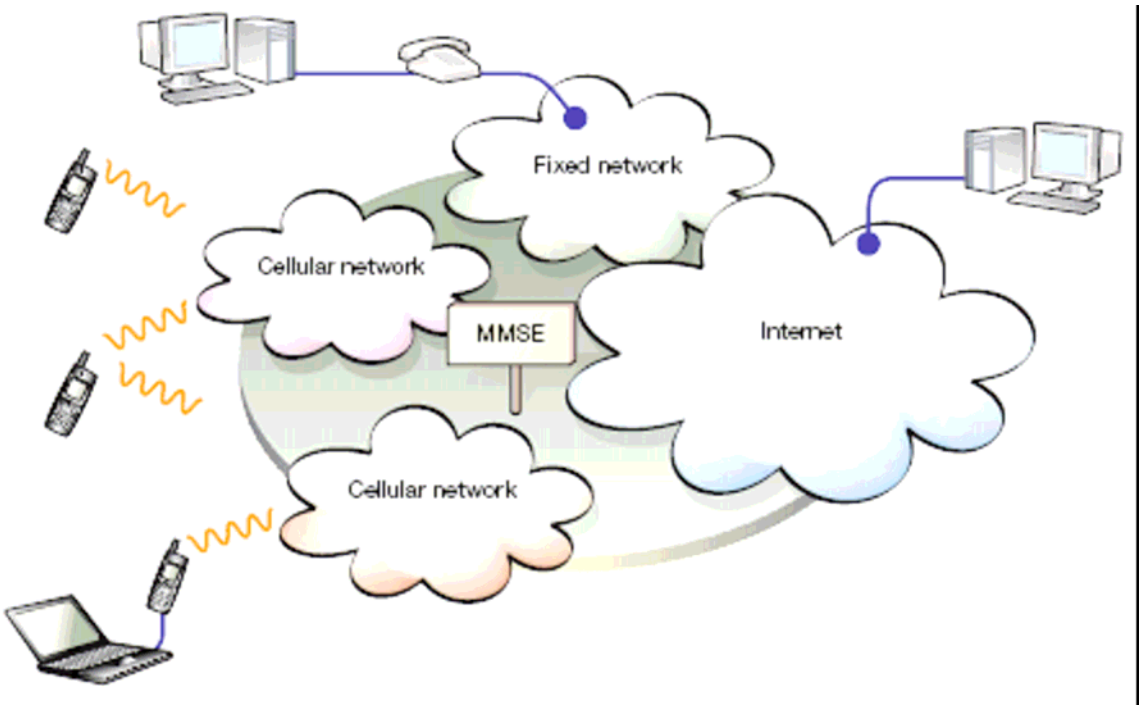


Fig. 2.37 MMS Architecture

Connectivity between different network types is provided by the Internet protocol (IP) and its associated set of messaging protocols. The MMS server is responsible for storing and handling incoming and outgoing messages. Associated with the MMS server is the MMS proxy relay, which is responsible for transferring messages between different messaging systems. The MMS server and MMS proxy relay can be

- Separate
- Combined in MMS center (MMS-C) or
- distributed across different domains

The MMS proxy relay can generate charging data (call detail record, CDR) when it receives multimedia messages or delivers them to an MMS user agent (client) or to another MMS environment. The MMS proxy relay is also responsible for converting messages that is, it adapts messages to the capabilities of the receiving device. A new

and important capability of the MMS-C is that it can identify the capabilities
of the receiving MMS terminal. The MMS-C converts the MMS message for the receiving terminal and maintains backward compatibility. For instance, if a new MMS terminal sends a high-resolution color image to an older MMS terminal that only supports black and white, low-resolution images, the MMS-C will convert the picture to black-and-white. This function applies to all content, such as video clips, still images, and MP3 files. These features media conversion and terminal capability negotiation are new in MMS and were missing in SMS. The interoperability problems we have today in SMS are thus resolved by MMS.

The MMS user database can comprise one or more entities that contain user-related information, such as subscription and configuration (for example, user profile or home location register). The MMS user agent is an application layer function that resides on a mobile device, or other external device and enables users to view, compose and handle (send, receive, delete, and so on) multimedia messages. As shown in below figure, MMS uses WAP as the bearer technology for mobile connectivity. The MMS network is built on top of the WAP architecture, in which the WAP gateway provides access to standard WAP facilities such as hypertext transfer protocol (HTTP) methods, push services, over-the air security, and capability negotiations. The payload, which includes the multimedia message, is transferred by the WAP session protocol (WSP) and HTTP. It includes several standardized fields, as described in the MMS Message Encapsulation specification. The following MMS services have been defined and standardized:

- multimedia message transmission to one or more destinations;
- multimedia message reception in the recipient MMSE upon reception, the recipient MMSE verifies the recipient user

profile and stores the multimedia message (until the message is delivered, forwarded, rejected or expires) as well as generates notification to the recipient MMS user agent

- multimedia message retrieval: the recipient MMS user agent can request delivery of a message from the recipient MMSE, based on the information received in the notification report;
- delivery report: this report can be requested by the originating MMS user agent
- read-reply report: this report can be requested by the originating MMS user agent
- Support for streaming data for downloading multimedia message content. Each of these services is realized by means of various abstract messages, using the standardized fields of the MMS Message Encapsulation specification.

MMS Message Flow

1 A message is sent to the server using the WAP post method over a connection oriented WAP session.

2 Notification is sent to the recipient client using WAP push (non-confirmed push).

3 The message is retrieved from the server using the WAP get method, invoked over a connection-oriented WAP session.

4 A delivery report (terminal-to-server) is sent using a connection-oriented WAP wireless session protocol (WSP) session.

5 A delivery report (server-to-terminal) is sent using connectionless push.

Below figure shows MMS transactional message flow in WAP medium.

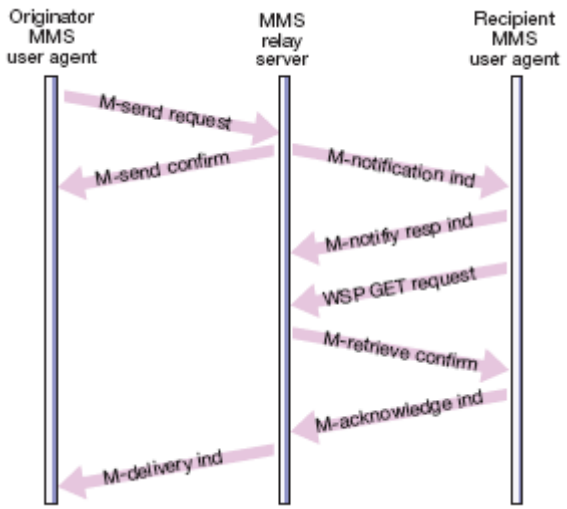


Fig. 2.38 MMS Message Flow

2.2.2 Wireless Access Protocol (WAP)

WAP stands for Wireless Application Protocol and is an industry-wide standard for accessing information and services from wireless devices. WAP is defined and coordinated by the WAP Forum, a consortium of industry players who have an interest in extending the kind of information and services that we have become used to accessing over the Internet, to users of wireless devices, including mobile phones, Palm, PDA. WAP Forum organization was founded in 1997 by Phone.com, Nokia, Ericsson and Motorola, and since then has grown to over 500 members. WAP is based on Internet standards and has been optimized for wireless environment (low bandwidth, low memory, small displays...). The WAP Forum's membership roster now includes computer industry heavyweights such as Microsoft, Oracle, IBM, and Intel along with several hundred other companies.

According to the WAP Forum, the goals of WAP are to be:

- Independent of wireless network standard.

- Open to all.
- Proposed to the appropriate standards bodies.
- Scalable across transport options.
- Scalable across device types.
- Extensible over time to new networks and transports.

As part of the Forum's goals, WAP will also be accessible to the following wireless communication technologies:

- GSM-900, GSM-1800, GSM-1900
- CDMA IS-95
- TDMA IS-136
- 3G systems - IMT-2000, UMTS, W-CDMA, Wideband IS-95

WAP Specifications

Wireless Application Environment

- WML Micro browser
- WMLScript Virtual Machine
- WMLScript Standard Library
- Wireless Telephony Application Interface (WTAI)
- WAP content types

Wireless Protocol Stack

- Wireless Session Protocol (WSP)
- Wireless Transport Layer Security (WTLS)
- Wireless Transaction Protocol (WTP)
- Wireless Datagram Protocol (WDP)
- Wireless network interface definitions

Layered telecommunication stack

- Datagram and Transactions
- Security
- Session

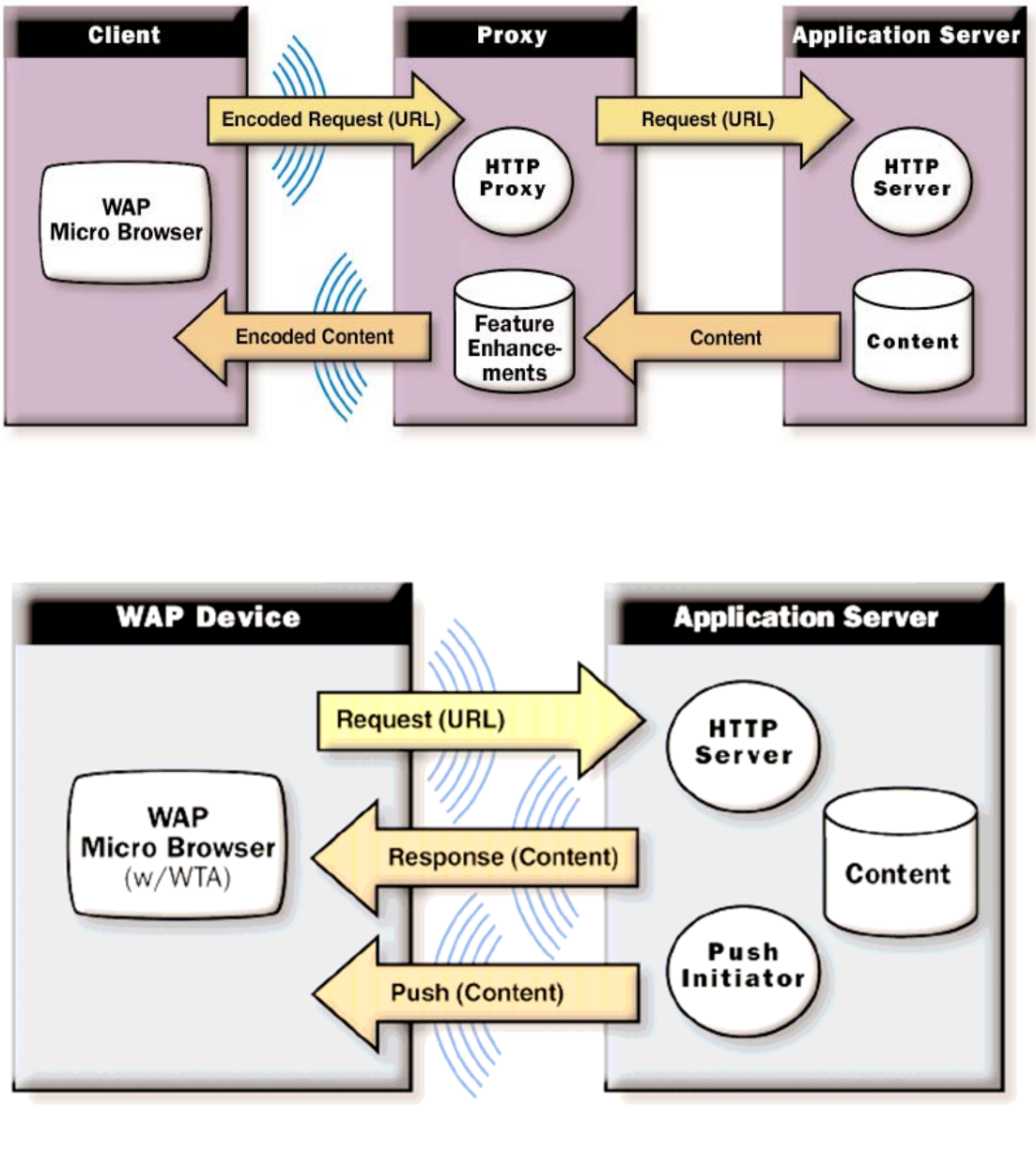


Fig. 2.39 WAP Model and WAP Server

We may extend our existing web server to server mobile device compatible information by producing WAP supportive content like WML pages or XHTML pages. The WAP gateway is the element in WAP architecture which is responsible to interpret the user's WAP request to respective HTTP request and pass it to existing web server the Web server solve the request and generate the WAP supportive content. The response generated by web server is delivering to WAP gateway through HTTP medium. The WAP

gateway again transfers response through WAP medium. So the WAP gateway performs the role of converts request and response from HTTP to WAP and WAP to HTTP. If the application server is directly placed at WAP gateway at that time terminology is called as a WAP server which perform duel role of Web server and WAP gateway. The Architecture is more specifically described in below figure.

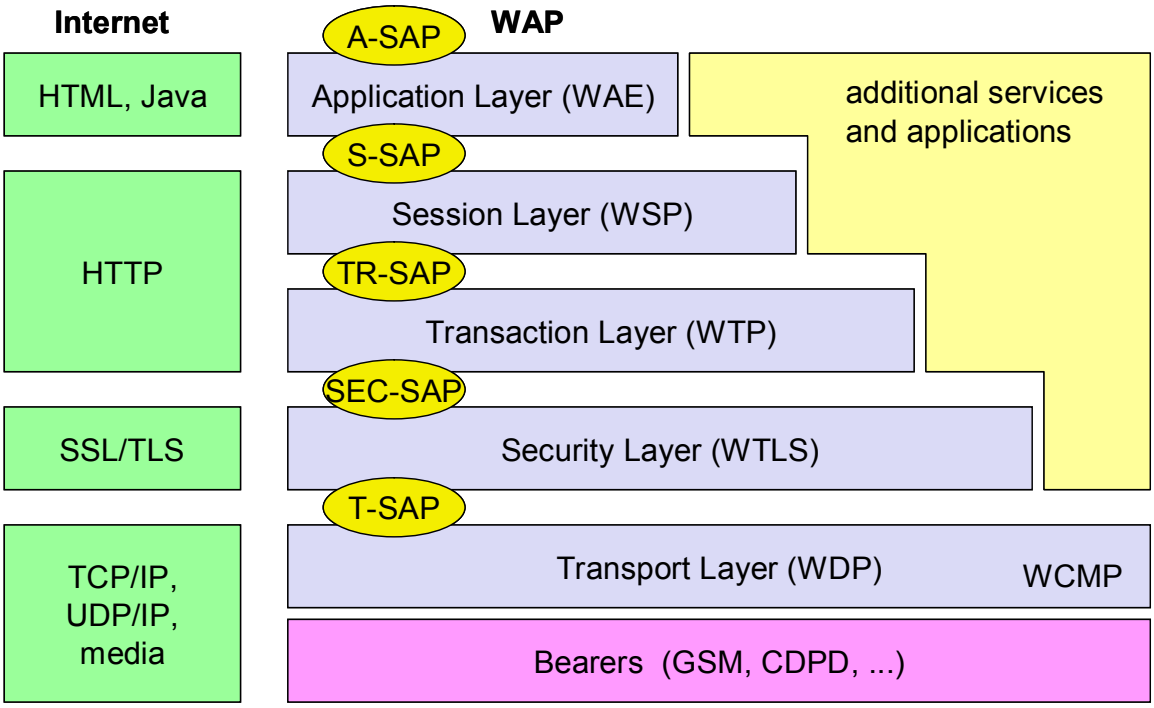


Fig. 2.40 WAP Layered Architecture

WAE (Wireless Application Environment)

It is first layer responsible to provide a application layer utility. The web browser is the application which facilities to interpret the WAP content. The WAP content is WML Pages, XHTML pages and multimedia data (image, audio, video…). WML script is also one important component having predefine library which is interpreted

by WMLScript virtual machine to execute meaningful instructions. And WTA: telephone services, such as call control, phone book etc.

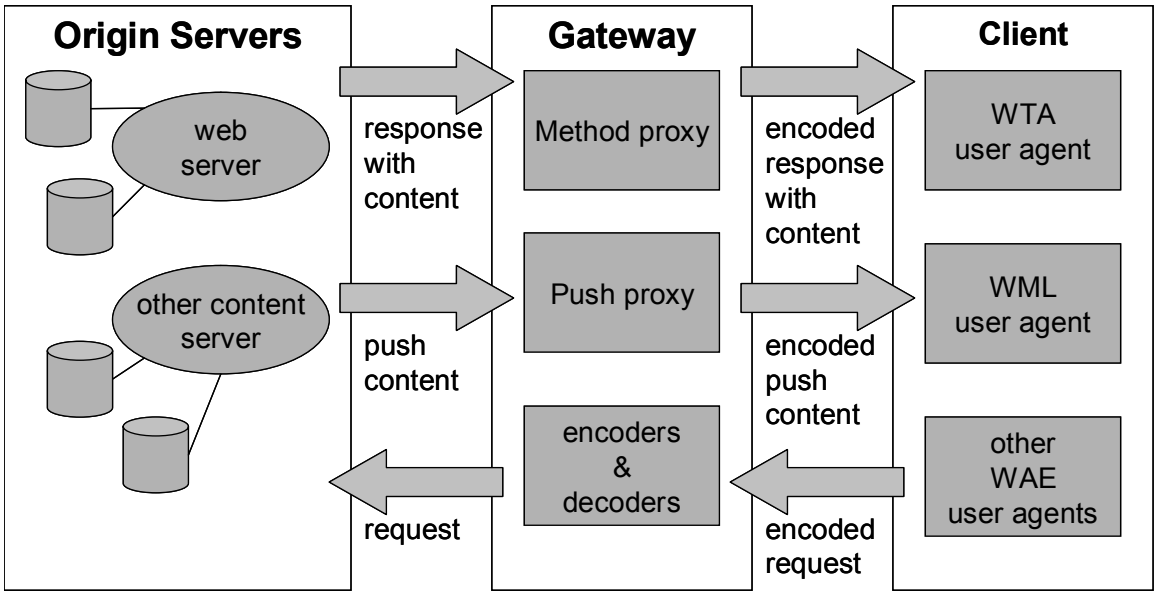


Fig. 2.41 Logical Model of Wireless Application Environment

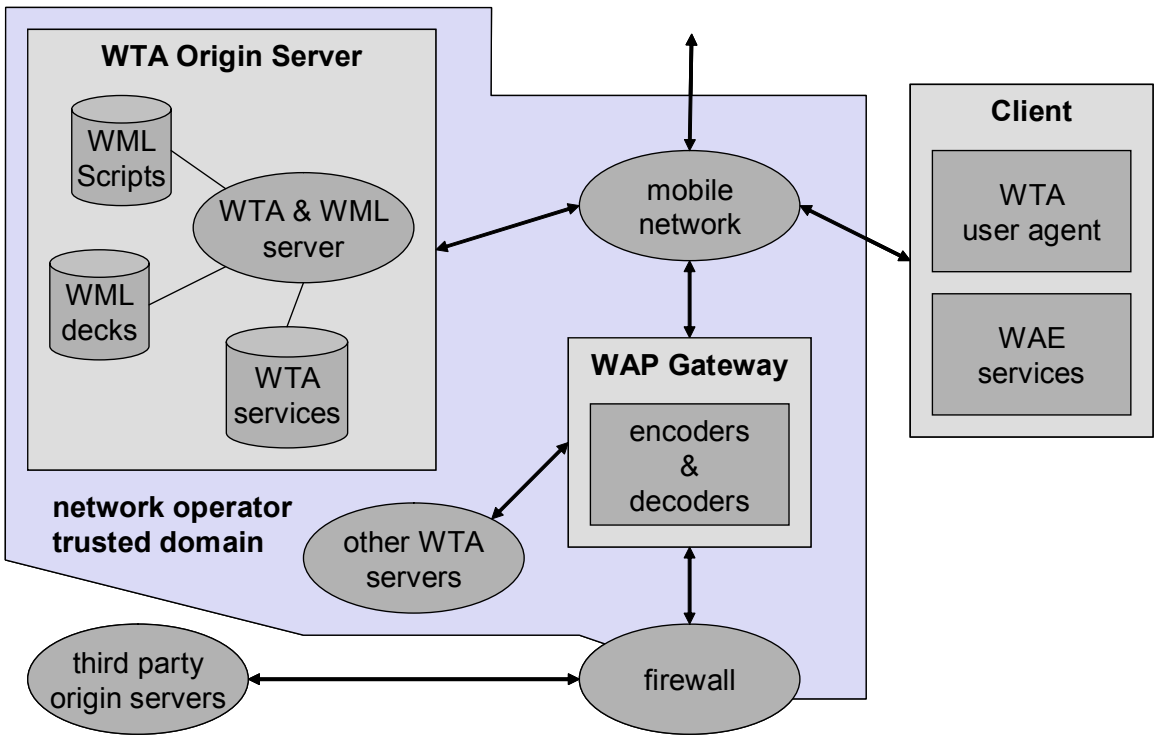


Fig. 2.42 Logical Model of Wireless Telephony Agent Environment

Wireless Session Protocol (WSP)

The session is important factor to make application effective for provides shared state between client and server optimizes content transfer. Session management consists establish of session, release of session data, suspend session, and resume session. WSP is responsible of handling these all activity with user and application. Key management, authentication, Internet security services also part of session and managed by WSP. WSP is also responsible for content encoding and push information management.

Wireless Transaction Protocol (WTP)

Different transaction services that enable applications to select reliability, efficiency levels are provides by Wireless Transaction Protocol. Low memory requirements, suited to simple devices are desired in wireless transmission. WTP also supports peer-to-peer, client/server and multicast applications.

Wireless Transport Layer Security (WTLS)

Wireless Transport Layer Security is based on the TLS/SSL (Transport Layer Security) protocol specifically optimized for low-bandwidth communication channels. WTLS provides privacy (encryption), data integrity (MACs), authentication (public-key and symmetric). Special adapted mechanisms for wireless usage in WTLS are long lived secure sessions and optimized handshake procedures.

Wireless Datagram Protocol (WDP)

Provides transport layer functions based on ideas from UDP. It Uses transport mechanisms of different bearer technologies offers a common interface for higher layer protocols. It also allows for transparent communication despite different technologies. Addressing uses port numbers. WDP over IP is called UDP/IP.

WAP Client

Primarily include wireless phones, PDAs and pagers. Beginning to support more memory, faster processing power and longer battery life. Contains a user agent or a mini-browser that implements WAE specification and can execute any WAP compliant application. Available in thousands of different models and types. A WAP compliant application written once can reach and be executed on all of theses devices

Application Server

Real power of WAP lies in the fact that it leverages existing Internet infrastructure to extend reach of applications to millions of users with wireless devices. Application servers typically consist of three tiers:

Web Server: understands HTTP protocol and responds to HTTP requests from the clients. E.g. Apache, iPlanet, Microsoft IIS etc.

Application Server: scripting engine which execute business logic as per the user demand. E.g. PHP, Perl, JVM etc.

Database Server: used for persistence storage of application data. E.g. Oracle, Sybase, MySQL, etc.

WAP Proxy or WAP Gateway

WAP utilizes proxy technology to optimize and enhance the connection between wireless domain and WWW. WAP proxy provides various functions including:

Protocol Gateway: Translates requests from a wireless protocol stack to the WWW protocols. Also performs DNS look up.

Content Encoders and Decoders: Translate WAP content into a compact format due to slow underlying wireless link and vice versa.

User Agent Profile Management: Enable personalization and customization of the device

Caching proxy: Improves perceived performance and network utilization by maintaining a cache of frequently accessed resources.

2.3 M-commerce requirement analysis

Mobile commerce application are service are business applications which serving the business services on mobile devices. The development of such application is extended through the existing business applications which serving their services on internet backbone. The research found that the m-commerce applications extended the existing e-commerce application with new presentation layer which facilities mobility. The research takes case study of two internet applications which is extended for pervasive devices usage with different application layer.

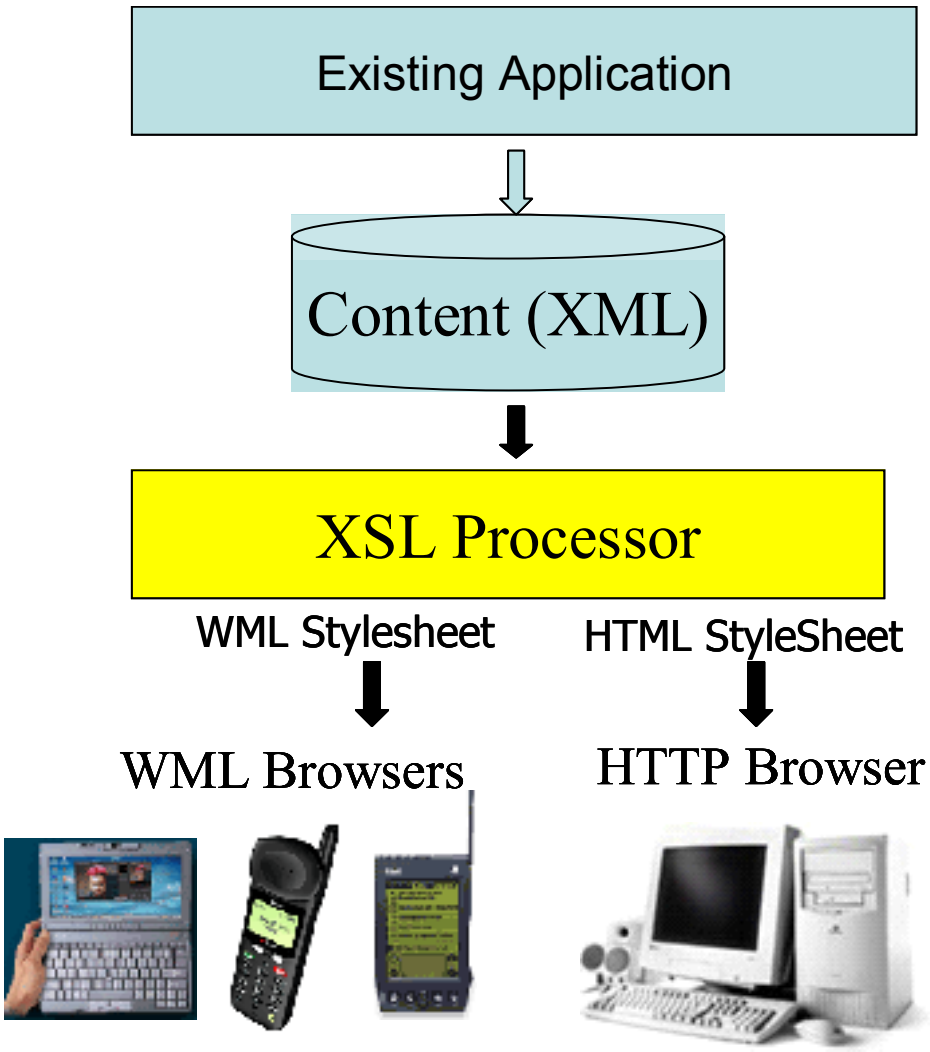


Fig. 2.43 Different Presentation for different devices

2.3.1 Western Railway Train Status Application case study

The Western Railway is the government organization which is providing railway services in Western zone of India. The organization has their portal facilitate the information of any train status running on the western zone. This application is extend for user having WAP compatible wireless device by rediff.com which provide valuable services through internet backbone. The rediff.com

portal has used the existing application and the existing data resources.

The Wireless Application running on rediff.com portal

http://mobile.rediff.com/index.wml is the URL of the application where research takes the case study. When user access this URL from their pervasive device it listed the page with links of different services as shown in following figure.

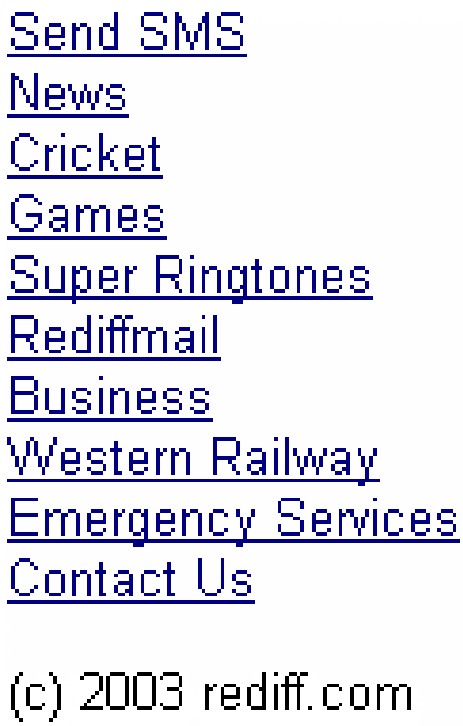


Fig. 2.44 Rediff.com application screen shots - 1

Among the listed services research focus on Western Railway train Status Services which is listed with hyperlink **Western Railway**. After selecting this service user receives following page which ask users to search their train through by name or by number as shown in following figure.

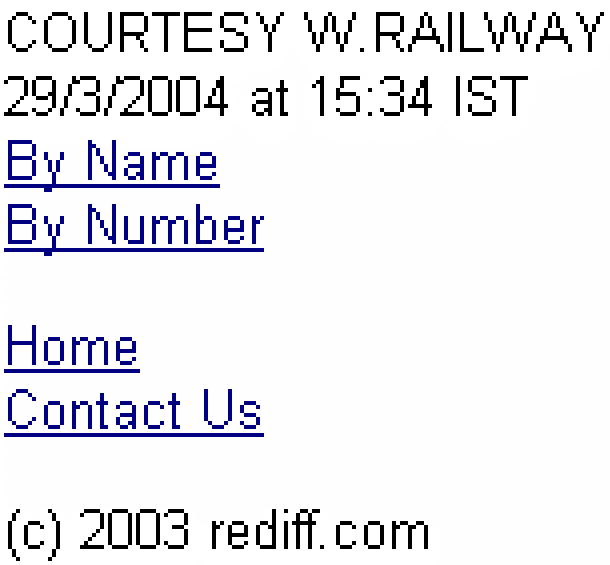
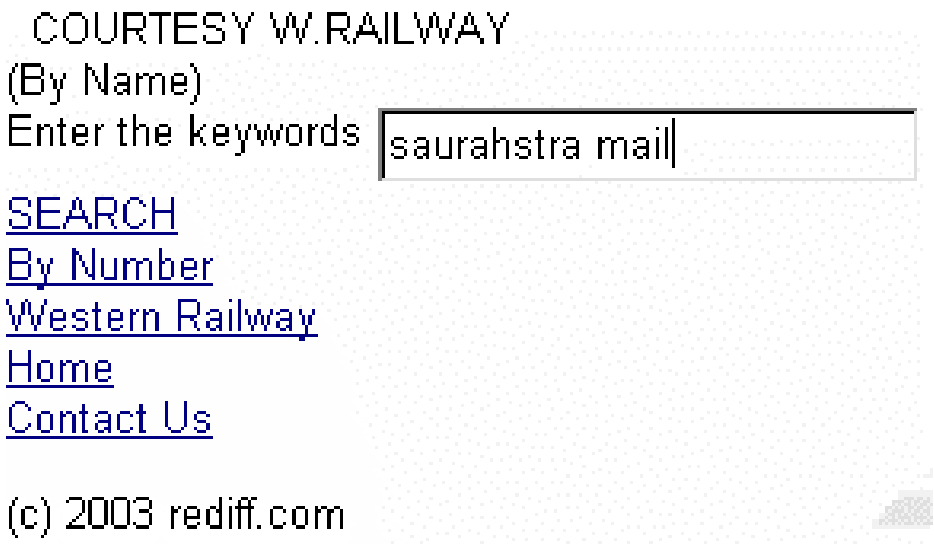


Fig. 2.44 Rediff.com application screen shots - 2

as per the selection of search methods by name or by number user will received following pages respectively.

By name



By Number

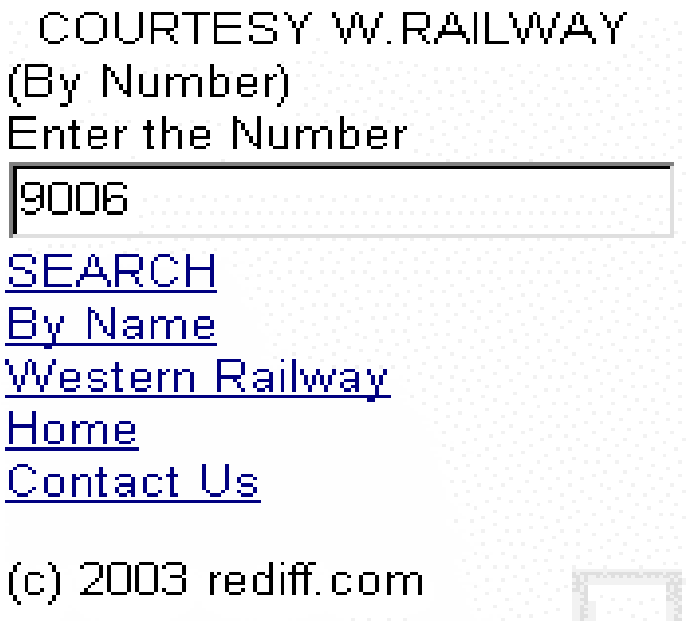


Fig. 2.44 Rediff.com application screen shots - 3

In our example we have enter the train number **9006** and get result page as shown in below page. Which describe that the train number **9006** is of **9006 UP SAURASHTRA MAIL**

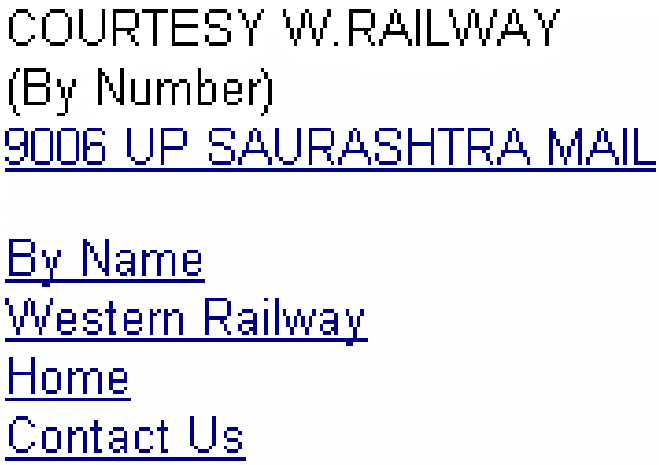


Fig. 2.44 Rediff.com application screen shots - 4

The users who do not know the train number may search their train by entering few characters of the train name. And get listed the

trains which match the user search keywords. In our example user enter **saurashtra mail** and get following page.

Fig. 2.44 Rediff.com application screen shots - 5

When the person select appropriate train the applications shows the information page of current train status. the following figure shows the train status of **9215 DN SAURASHTRA EXPRESS** when user select the link where the train is listed after search results.

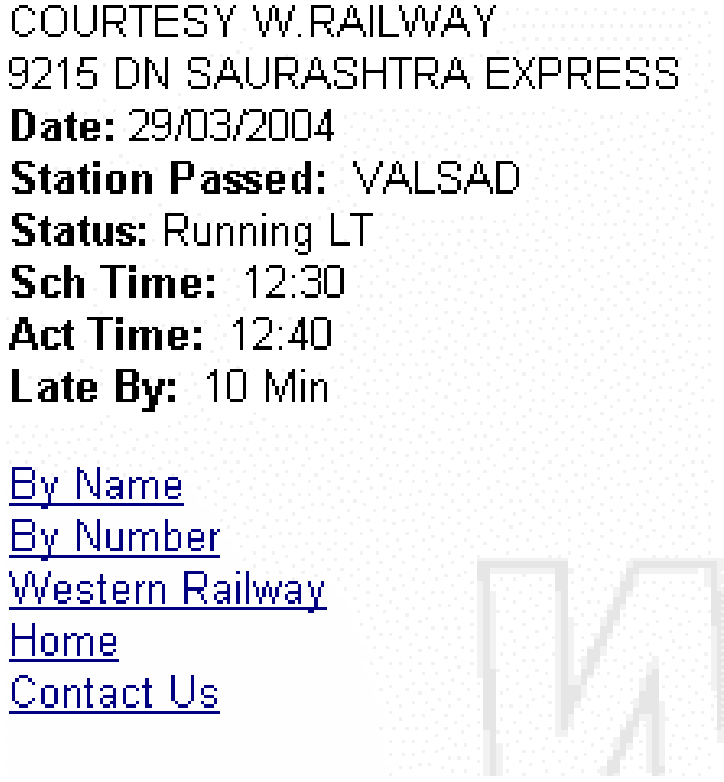


Fig. 2.44 Rediff.com application screen shots - 6

The result comes with information of the last station leaved by the train "9215" on 29/03/2004. And the conclusion is "9215" left "VALSAD" at "12:40" but it has to left at "12:30. So, the "9215" is running 10 Min late from its schedule. It shows the feasible usage of application. As the users who are planning to catch this train from next station from valsad may utilized their 10 mins by accessing this applications from their pervasive devices. If the same application is running on the internet backbone users may only benefited while they have computing node to access the application. But this application is need when user may on the run or some where else where computing facilities is not available. While he may carry his WAP internet service enable mobile devices with him every time. The usage of application itself proves that it is only feasibility while it serves to wireless devices.

Implementation of Application

To design the system in which the information is accessed from mobile doesn't need to design different architecture and different resources. The mobile based application can even access the existing resources which are already in the World Wide Web. The web server http://www.westernrailwayindia.com of Western Railway already has information regarding trains schedules updated from western zone railway stations. rediff.com access that resources and design the services which can access from pervasive devices (here, WAP enable devices). The rediff.com portal designed new presentation layer on existing application which may generate the results in WML pages which is accessible through internet enable pervasive device.

Stations of Western railway zone are updating the train information to the central railway server. And the portal of the western railway is serving the information by web pages by using that data in the internet backbone. Rediff.com portal is also accessing the same data and presenting the information in WML pages for pervasive devices. Where the users are requesting for the pages through their services provider network, and WAP gateway. The WAP gateway is collecting the request which comes through WAP medium and transfer to rediff.com portal in the form of HTTP. The generated response is again delivering through HTTP medium to WAP gateway. The WAP gateway delivers it to WAP medium to the end user in their Mobile Station. The deliver path of the request and application architecture is shown in following figure.

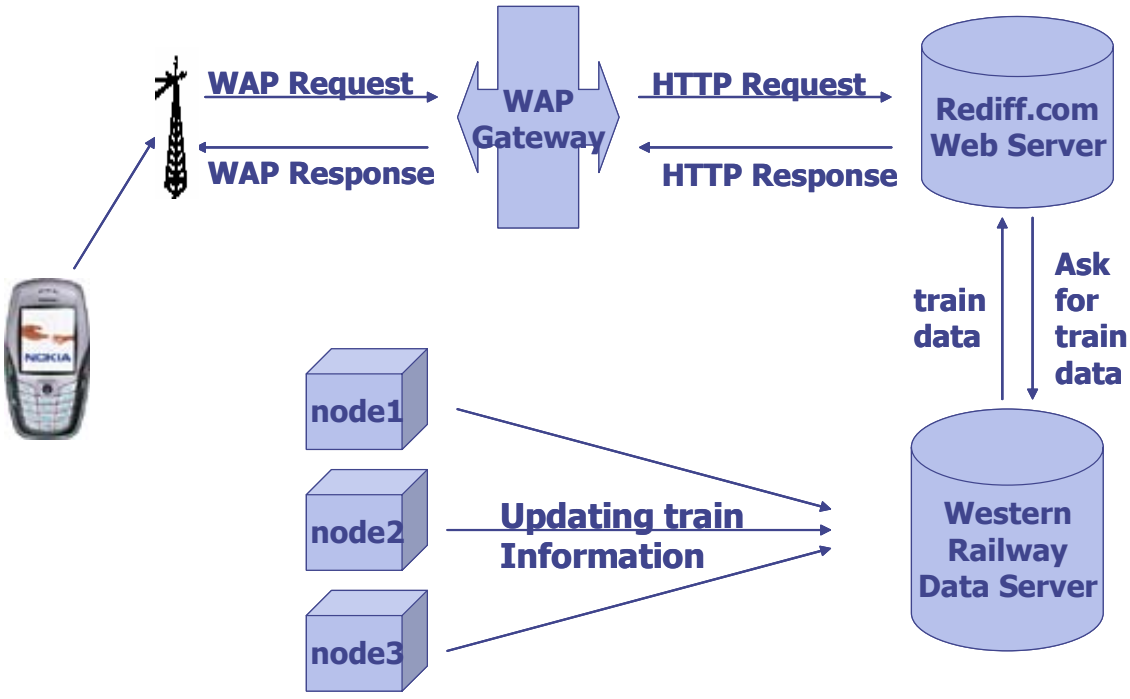


Fig. 2.45 Western railway train stats application architecture

2.3.2 Online-Connectivity Monitoring Application case Study

This case study is taken from watch4you.com. The Service offered by the portal is of network monitoring. They providing checks user's Online-Connectivity. The Service will behave like a normal Customer that visits user's Site from the Internet. With that, user is ensuring that all Services are running fine on their network. watch4you.com will check if Site is up and running (Normal connectivity). Additionally they can also control if Mail-Servers are running properly (POP3,SMTP) etc. If they are detecting errors, they will be sent to users wireless device via SMS. Even user may check network log through WAP services.

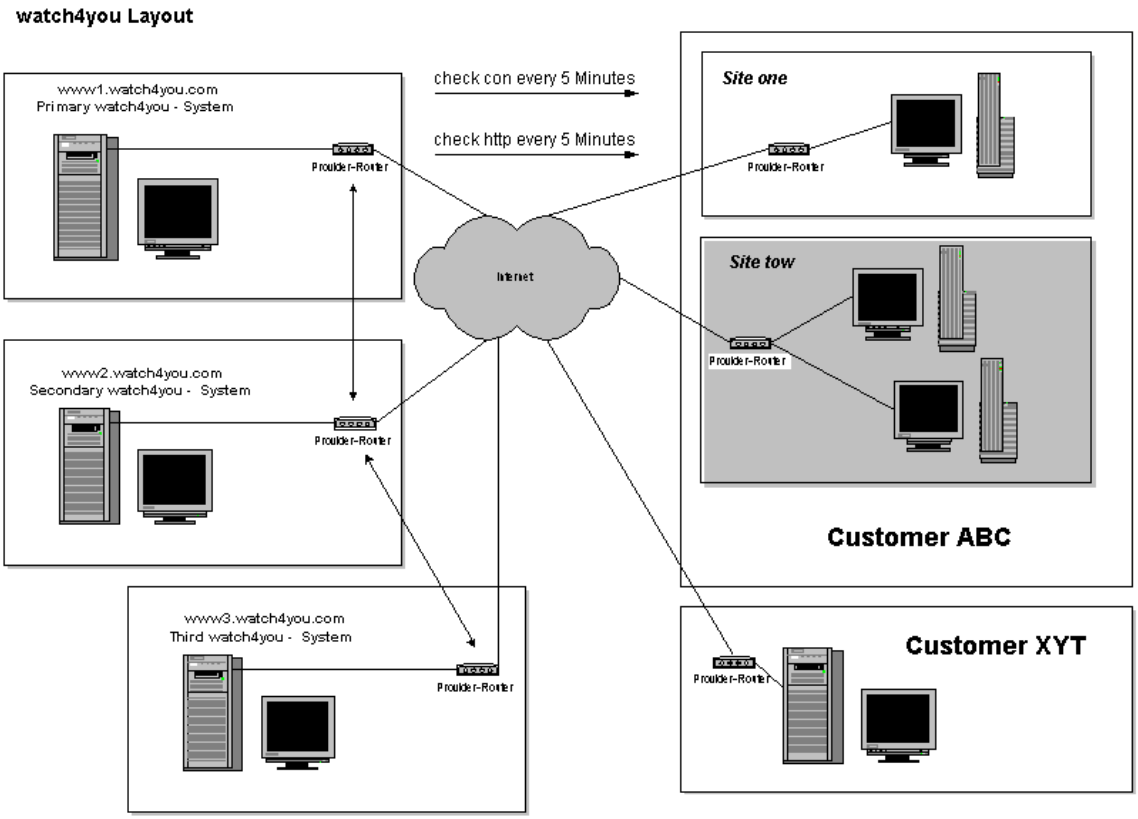


Fig. 2.46 WAP monitoring

watch4you.com servers are ever monitoring through their system. The monitoring services are also classified through various servers.

And they generate the log of their client's system. And make it available so that user may check that information through wireless devices. The old system is alerting through mail or telephony which is not feasible as user may able to trace the network problem while he has computing node available with him. But it is feasible in the case where user will get access of network monitory log available in his wireless devices through the application which watch4you.com is offering.

In this case also user need to ever monitor the log of the system to check the network status. the watch4you.com has extended the services so that the application server monitor the log and generate the report where the fault found. And then application server passes the messages to the client by checking the log.

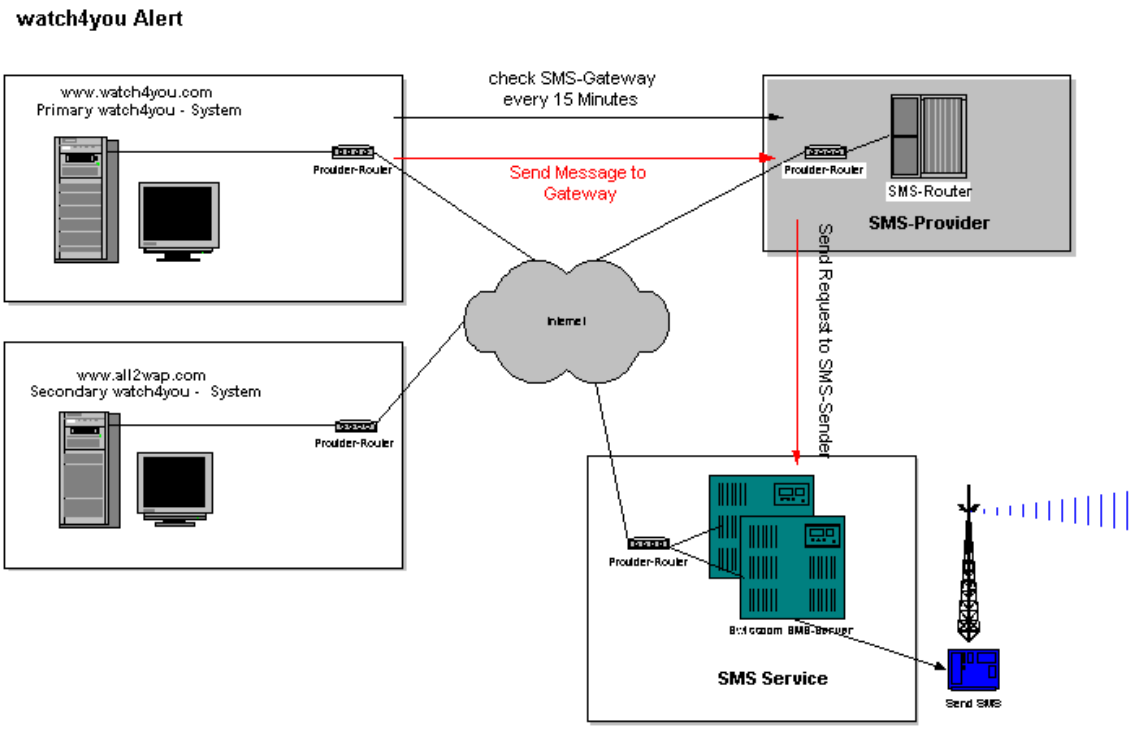


Fig. 2.47 Monitor system architecture

user do not need to check the log after registering for this service. When the fault arrives in his network. the application server of

watch4you.com is alerting through SMS to the user about the occurrence of fault in the network.

The services of the application provide the meaningful alerts by just replacing the presentation layer of the application and it increase the feasibility of the service offered by watch4you.com

2.3.3 Helsana Health Insurance: Marketing Strategy case study

The Helsana Versicherungen AG (Helsana Company) emerged from the merger of Helvetia (79%) und Artisana (21%) health insurances. Helsana offers various kinds of health insurance services. With more than 1.4 million Customers and 2,600 employees Helsana is the largest health insurance provider in Switzerland. The yearly premium yield sums up to CHF 3.8 billion (US$ 2.5 billion). With its image and offerings Progress mainly addresses young customers. The average age of the customer base in 2001 was 29.9 years. The premium yield in 2001 was CHF 60.2 million (US$ 43.2 million).

Challenging Problem

Usually, in Switzerland, insurants can switch their health insurance provider only with an effective date of December 31st (except standard health insurance plans with a fixed franchise of CHF 230 which can be switched with an effective date of June 30th). Insurants have to cancel their contract by November 30th (May 31st, respectively). Thus the willingness of switching and the interest in health care offerings and premium calculation rises rapidly in fall. Hence health insurance providers conduct heavy marketing activities trying to keep existing and acquire new customers. The time period at the end of each year is the only time where health insurance providers in Switzerland can work their

customer base. It is of crucial importance for the providers to place their own offering well visible among the offerings of competitors. Therefore effective addressing of the potential customer base is crucial for a successful acquisition process. For this reason Helsana is looking for innovative ways to communicate with prospects and customers.

By offering self-service options processes are outsourced to the customer, reducing acquisition und service costs. For example, customers can select insurance plans and immediately sign up through the company homepage. Only the legally binding signature must still be done paper-based through traditional mail, due to legal requirements by Swiss law. A new act for the emancipation of digital signatures is under way though. The product selection process is supported by a web-based premium calculator embedded in the company homepage. The affordable pricing and the online self-service options specifically attract younger people. Insurance contracts can be closed online.
Customers can also contact the call center and receive individual assistance, consulting and close a contract.

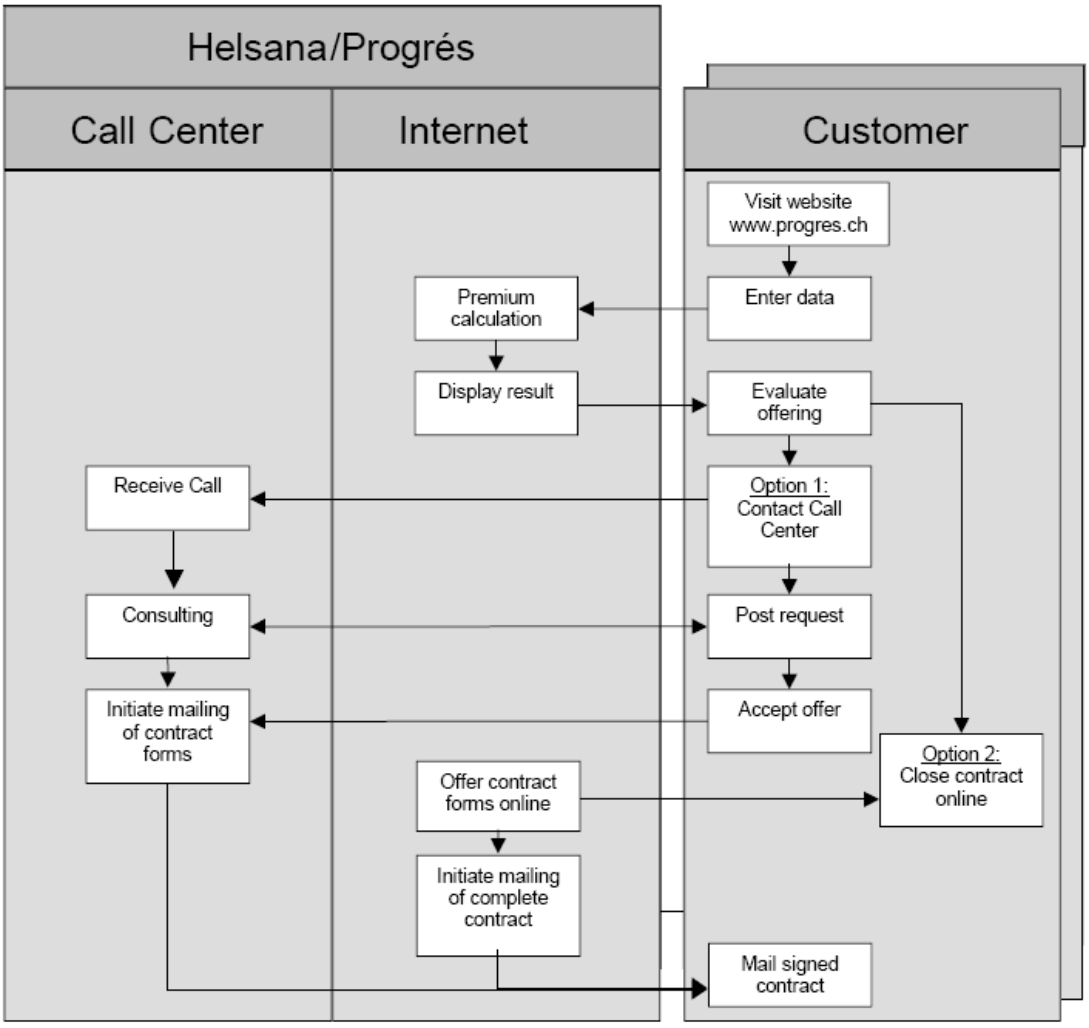


Fig. 2.48 Internet Application Model of Helsana Health Insurance

The success of the brand Progress since the introduction of the new homepage in 2001 has proven the potential of the Internet channel. Helsana has not yet gained any experiences with a mobile channel, but is willing to explore the possible applications and potentials of this innovative sales and marketing channel. Helsana decided to take first steps towards m-commerce. This innovation was planned to be used by the Progress brand first in order to achieve a further differentiation of the brands Helsana and Progress. Also, a higher response premium was expected from the target group of Progress as compared to the Helsana customers. During the new project

company extend their existing internet based application with pervasive computing device accessibility of the application.

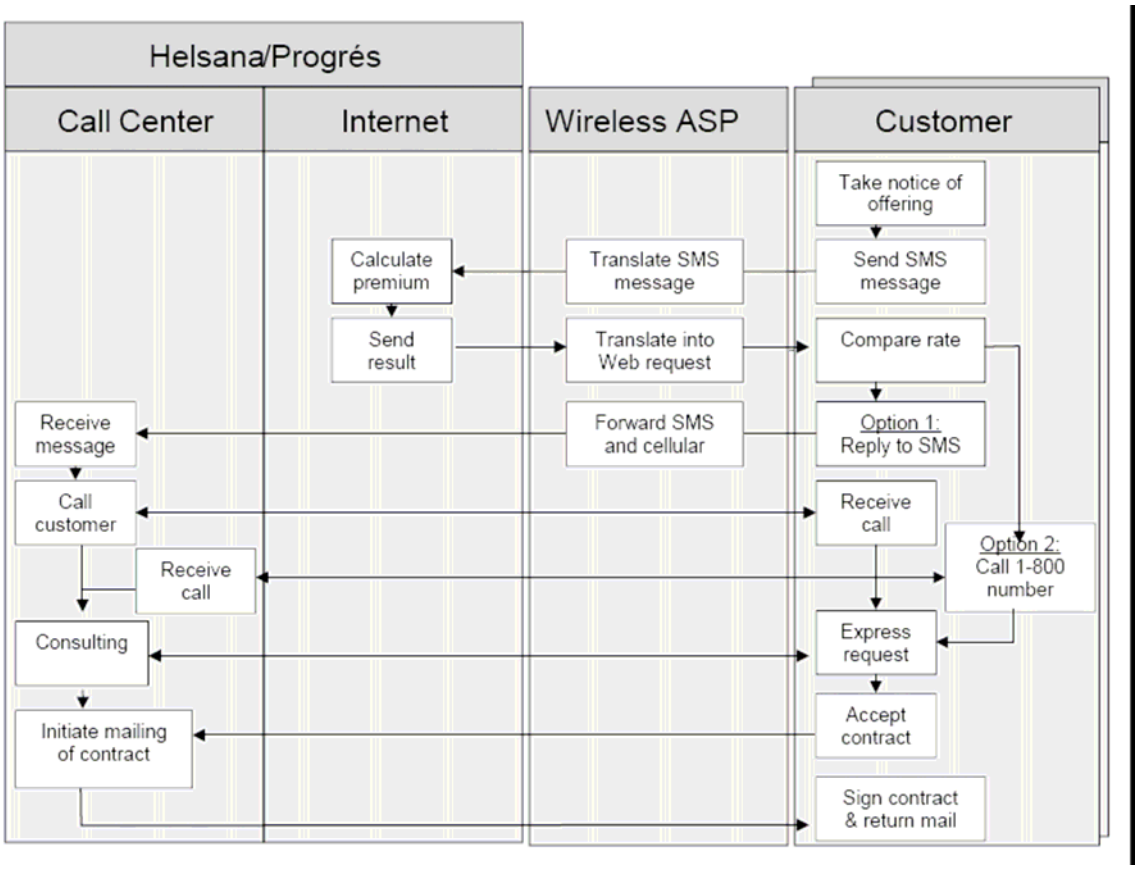


Fig. 2.49 Mobile based Application Model of Helsana Health Insurance

Helsana successfully used the environment of it's subsidiary Progress for evaluating the mobile channel and identifying crucial success factors for mobile commerce projects. Due to the comparatively small size of Progress and the availability of reusable components costs could be kept low. The company has gained from new technological implementation of mobile commerce in its business strategy and reduces the implementation cost by using existing model.

These case studies prove that low cost mobile commerce implementation is possible through hiring existing e-commerce model.

2.4 Language and Tools Selection for proposed m-commerce model

As a part of development of proposed m-commerce model research has taken study of various Languages and tools. The study involves the basic markup languages, Scripting Languages, Emulators for the testing of application and Server and Gateway support to deliver the information on wireless nodes.

2.4.1 Markup Languages

Markup languages are basic language which performs a role of information delivery medium in any applications in different environment. The research proposes model is designed in wireless environment specifically mobile based environment. Where WML and XHTML is performing role of markup languages as per WAP Forum specification. WAP Forum is an industry group dedicated to the goal of enabling sophisticated telephony and information services on handheld wireless devices.

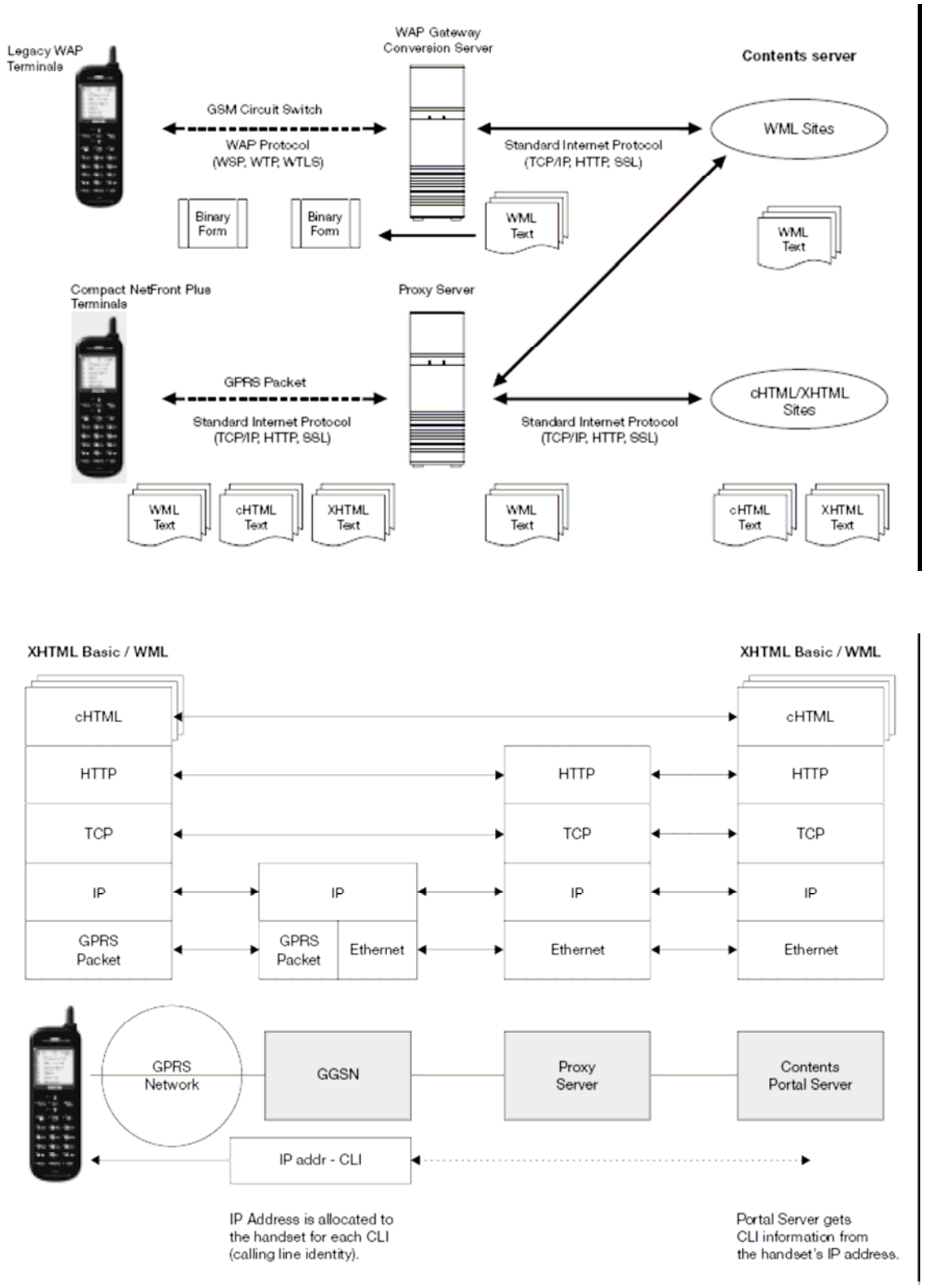


Fig. 2.50 Protocol Layers and Markup Languages

WML (The first Markup Language for Wireless Devices)

Wireless Application Protocol (WAP) is a result of continuous work to define an industry-wide specification for developing applications that operate over wireless communication networks. The scope for the WAP Forum is to define a set of specifications to be used by service applications. The wireless market is growing very quickly and reaching new customers and services. To enable operators and manufacturers to meet the challenges in advanced services, differentiation and fast/flexible service creation, WAP defines a set of protocols in transport, session and application layers. For additional information on the WAP architecture, refer to "Wireless Application Protocol Architecture Specification" called WAP specifications.

This specification defines the Wireless Markup Language (WML). WML is a markup language based on XML and is intended for use in specifying content and user interface for narrowband devices, including cellular phones and pagers. WML is designed with the constraints of small narrowband devices in mind. These constraints include:

- Small display and limited user input facilities
- Narrowband network connection
- Limited memory and computational resources

WML includes four major functional areas:

- **Text presentation and layout:** WML includes text and image support, including a variety of formatting and layout commands. For example, boldfaced text may be specified.

- **Deck/card organizational metaphor:** all information in WML is organized into a collection of cards and decks. Cards specify one or more units of user interaction (e.g., a choice

menu, a screen of text or a text entry field). Logically, a user navigates through a series of WML cards, reviews the contents of each, enters requested information, makes choices and moves on to another card. Cards are grouped together into decks. A WML deck is similar to an HTML page, in that it is identified by a URL and is the unit of content transmission.

- **Inter-card navigation and linking:** WML includes support for explicitly managing the navigation between cards and decks. WML also includes provisions for event handling in the device, which may be used for navigational purposes or to execute scripts. WML also supports anchored links, similar to those found in HTML4.
- **String parameterization and state management:** all WML decks can be parameterized using a state model. Variables can be used in the place of strings and are substituted at run-time. This parameterization allows for more efficient use of network resources.

WML (Wireless Markup Language) 1.x is the markup language defined in the WAP 1.x specification. It specifies the protocol stack and application environment of mobile Internet browsing applications. The role of WML in mobile Internet applications is the same as that of HTML in web applications. WAP sites are written in WML, while web sites are written in HTML. WML 1.x is very similar to HTML. Both of them use tags and are written in plain text format. Some tags in WML 1.x are directly borrowed from HTML. If System Administrator have experience in using the HTML markup language, System Administrator should be able to learn WML 1.x quickly. Some features of WML 1.x are specific to wireless devices. For example, WML 1.x provides a way for developers to program the

soft keys of mobile phones. This feature is not supported in HTML since computers do not have any soft key. The most up-to-date version of the WAP 1.x specification is WAP 1.2.1, which defines WML 1.3. WML files have the extension ".wml". WML supports client-side scripting. The scripting language supported is called WMLScript. Its syntax is based on JavaScript.

WML is designed to meet the constraints of a wide range of small, narrowband devices. These devices are primarily characterized in four ways:

- Display size: smaller screen size and resolution. A small mobile device such as a phone may only have a few lines of textual display, each line containing 8-12 characters.
- Input devices: A limited or special-purpose input device. A phone typically has a numeric keypad and a few additional function-specific keys. A more sophisticated device may have software-programmable buttons, but may not have a mouse or other pointing device.
- Computational resources - low power CPU and small memory size; often limited by power constraints.
- Narrowband network connectivity: low bandwidth and high latency. Devices with 300bps to 10kbps network connections and 5-10 second round-trip latency are not uncommon.

WAP forum has defined broad classes of device functionality:

- Phone: the typical display size ranges from two to ten lines. Input is usually accomplished with a combination of a numeric keypad and a few additional function keys. Computational resources and network throughput is typically limited, especially when compared with more general-purpose computer equipment.

- PDA: a Personal Digital Assistant is a device with a broader range of capabilities. When used in this document, it specifically refers to devices with additional display and input characteristics. A PDA display often supports resolution in the range of 160x100 pixels. A PDA may support a pointing device, handwriting recognition and a variety of other advanced features.

WML and URL

WML assumes the same reference architecture as HTML and the World Wide Web. Content is named using URLs and is fetched over standard protocols that have HTTP semantics, such as [WSP]. In WML, URLs are used in the following situations:

- When specifying navigation, e.g., hyperlinking.
- When specifying external resources, e.g., an image or a script.

WML browsers must implement the URL schemes specified in [WAE]. WML has adopted the HTML de facto standard of naming locations within a resource. A WML fragment anchor is specified by the document URL, followed by a hash mark (#), followed by a fragment identifier. WML uses fragment anchors to identify individual WML cards within a WML deck. If no fragment is specified, a URL names an entire deck. In some contexts, the deck URL also implicitly identifies the first card in a deck. WML has adopted the use of relative URLs, specifies the method used to resolve relative URLs in the context of a WML deck. The base URL of a WML deck is the URL that identifies the deck.

WML Character Set

WML is an XML language and inherits the XML document character set. In SGML nomenclature, a document character set is the set of all logical characters that a document type may contain (e.g., the letter 'T' and a fixed integer identifying that letter). An SGML or XML

document is simply a sequence of these integer tokens, which taken together form a document. The document character set for XML and WML is the Universal Character Set of ISO-10646. Currently, this character set is identical to Unicode 2.0. WML will adopt future changes and enhancements to the [XML] and [ISO10646] specifications. Within this document, the terms ISO10646 and Unicode are used interchangeably and indicate the same document character set. There is no requirement that WML decks be encoded using the full Unicode encoding (e.g., UCS-4). Any character encoding ("charset") that contains a proper subset of the logical characters in Unicode may be used (e.g., US-ASCII, ISO-8859-1, UTF-8, Shift_JIS, etc.). Documents not encoded using UTF-8 or UTF-16 must declare their encoding as specified in the XML specification and should include Content-Type meta-information.

WML documents maybe encoded with any character encoding as defined by HTML4. Character encoding of a WML document may be converted to another encoding (or transcoded) to better meet the usergent's characteristics. However, transcoding can lead to loss of information and must be avoided when the user agent supports the document's original encoding. Unnecessary transcoding must be avoided when information loss will result. If required, transcoding should be done before the document is delivered to the user agent. This specification does not mandate which character encoding a user agent must support. Since WML is an XML application, the character encoding of a WML document is determined as defined in the XML specification [XML]. In normal cases it is always possible to detect the character encoding of the document (all other cases are error situations). The meta http-equiv statement, if any is present in the document, is never used to determine the character encoding. If a WML document is transformed into a different format than XML - for example, into the binary WBXML format - then, the rules

relevant for that format are used to determine the character encoding. When WML document is accompanied by external information (e.g. HTTP or MIME) there may be multiple sources of information available to determine the character encoding. In this case, their relative priority and the preferred method of handling conflict should be specified as part of the higher-level protocol. See, for example, the documentation of the "text/vnd.wap.wml" and "application/vnd.wap.wmlc" MIME media types.

The WML reference-processing model is as follows. User agents must implement this processing model, or a model that is indistinguishable from it.

- User agents must correctly map to Unicode all characters in any character encoding that they recognize, or they must behave as if they did.
- Any processing of entities is done in the document character set.

WML supports both named and numeric character entities. An important consequence of the reference processing model is that all numeric character entities are referenced with respect to the document character set (Unicode) and not to the current document encoding (charset). This means that Į always refers to the same logical character, independent of the current character encoding. WML supports the following character entity formats:

- Named character entities, such as & and &lt
- Decimal numeric character entities, such as &#32
- Hexadecimal numeric character entities, such as &#x20

XHTML (new generation Wireless Markup Language)

The Extensible Hypertext Markup Language (XHTML) is a family of current and future document types and modules that reproduce,

subset, and extend HTML, reformulated in XML. XHTML Family document types are all XML-based, and ultimately are designed to work in conjunction with XML-based user agents. XHTML is the successor of HTML, and a series of specifications has been developed for XHTML. XHTML 1.0 is the W3C's first Recommendation for XHTML, following on from earlier work on HTML 4.01, HTML 4.0, HTML 3.2 and HTML 2.0. With a wealth of features, XHTML 1.0 is a reformulation of HTML 4.01 in XML, and combines the strength of HTML 4 with the power of XML. XHTML 1.0 is the first major change to HTML since HTML 4.0 was released in 1997. It brings the rigor of XML to Web pages and is the keystone in W3C's work to create standards that provide richer Web pages on an ever increasing range of browser platforms including cell phones, televisions, cars, and wallet sized wireless communicators, PDA, and Palm. XHTML 1.0 is the first step and the HTML Working Group is busy on the next. XHTML 1.0 reformulates HTML as an XML application. This makes it easier to process and easier to maintain. XHTML 1.0 borrows elements and attributes from W3C's earlier work on HTML 4, and can be interpreted by existing browsers, by following a few simple guidelines. This allows to start using XHTML now! User can roll over System’s old HTML documents into XHTML using an Open Source HTML Tidy utility. This tool also cleans up markup errors, removes clutter and prettifies the markup making it easier to maintain.

XHTML Basic is the second Recommendation in a series of XHTML specifications. The XHTML Basic document type includes the minimal set of modules required to be an XHTML Host Language document type, and in addition it includes images, forms, basic tables, and object support. It is designed for Web clients that do not support the full set of XHTML features; for example, Web clients such as mobile phones, PDAs, pagers, and settop boxes. The

document type is rich enough for content authoring. XHTML Basic is designed as a common base that may be extended. For example, an event module that is more generic than the traditional HTML 4 event system could be added or it could be extended by additional modules from XHTML Modularization such as the Scripting Module. The goal of XHTML Basic is to serve as a common language supported by various kinds of user agents. The document type definition is implemented using XHTML modules as defined in "Modularization of XHTML".

Modularization of XHTML

Modularization of XHTML is the third Recommendation in a series of XHTML specifications. This Recommendation specifies an abstract modularization of XHTML and an implementation of the abstraction using XML Document Type Definitions (DTDs). This modularization provides a means for sub setting and extending XHTML, a feature needed for extending XHTML's reach onto emerging platforms. Modularization of XHTML will make it easier to combine with markup tags for things like vector graphics, multimedia, math, electronic commerce and more. Content providers will find it easier to produce content for a wide range of platforms, with better assurances as to how the content is rendered. The modular design reflects the realization that a one-size-fits-all approach will no longer work in a world where browsers vary enormously in their capabilities. A browser in a cellphone can't offer the same experience as a top of the range multimedia desktop machine. The cellphone doesn't even have the memory to load the page designed for the desktop browser.

The architecture of XHTML's modularization:

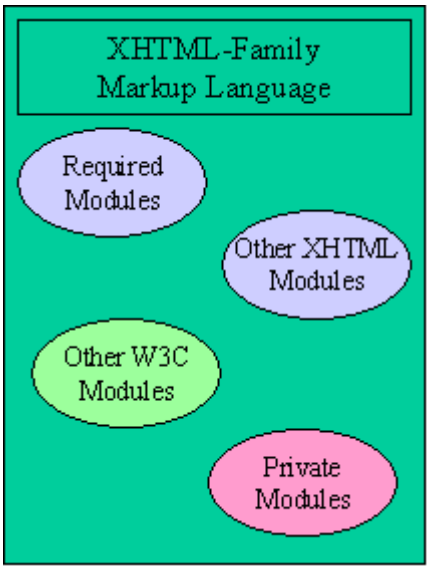


Fig. 2.51 The architecture of XHTML's modularization

a basic framework of XHTML modules enables the development of XHTML-conforming markup languages. These new languages must use the basic framework, and may also use other XHTML-provided modules, other W3C-defined modules, or indeed any other module that is correctly defined. The modules plug together within the XHTML framework to define a markup language that is task or client specific, but which is based upon the familiar (X)HTML structure. This new markup language is appropriate for a development of portable, XHTML-conforming content. Documents developed against this new markup language will be usable on any XHTML-conforming clients. In many cases, the content will also be portable to existing HTML 4 browsers. XHTML does not require the use of a specific markup language description format. Instead, it defines its modules using abstract prose and implements the abstraction using formats such as XML DTDs and XML Schema. Each implementation places some structural requirements on the way in which modules can be plugged together. However, in general it permits the definition of an XHTML-conforming markup language by merely taking a (supplied) markup language template and adding into that template references to the modules that are needed by the markup language

XHTML Modularization is a framework for defining markup languages. Such languages are independent grammars with their own schema. These schemas define the structure of content developed using the languages in addition to defining the elements and attribute that make up the vocabulary of the languages. Such markup languages are orthogonal to the concept of "XML Namespaces". An XML Namespace is a way of mapping specific element or attributes references within a document to collections of elements and attributes through the use of prefixes on the element or attribute names. The combination of elements and attributes from various grammars via the XML Namespace mechanism results in a compound document. XHTML-family markup languages can be used in these documents. The use, or lack of use, of an XML Namespace in relation to an XHTML-family markup language is independent of the language's use as a complete, freestanding markup language. Both uses are possible. However, a document is XHTML conforming only when it uses an XHTML-family markup language as document type, and when it validates against the schema for that markup language

Three "flavors" of XHTML 1.0

XHTML 1.0 is specified in three "flavors". System Administrator can specify which of these variants can be used by inserting a line at the beginning of the document. For example, the HTML for this document starts with a line which says that it is using XHTML 1.0 Strict. Thus, if the documents needs to be validated, the tool used knows which variant are being used. Each variant has its own DTD - Document Type Definition - which sets out the rules and regulations for using HTML in a succinct and definitive manner.

- **XHTML 1.0 Strict:** Use this when really clean structural mark-up is needed, free of any markup associated with layout. Use this together with W3C's Cascading Style Sheet language (CSS) to get the font, color, and layout effects as per the requirements.

- **XHTML 1.0 Transitional:** Many people writing Web pages for the general public to access might want to use this flavor of XHTML 1.0. The idea is to take advantage of XHTML features including style sheets but nonetheless to make small adjustments to markup for the benefit of those viewing pages with older browsers which can not understand style sheets. These include using the body element with bgcolor, text and link attributes.

- **XHTML 1.0 Frameset:** Use this when Frames to partition the browser window into two or more frames.

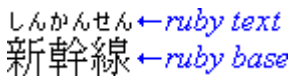
XHTML-Print

XHTML-Print is member of the family of XHTML Languages defined by the Modularization of XHTML. It is designed to be appropriate for printing from mobile devices to low-cost printers that might not have a full-page buffer and that generally print from top-to-bottom and left-to-right with the paper in a portrait orientation. XHTML-Print is also targeted at printing in environments where it is not feasible or desirable to install a printer-specific driver and where some variability in the formatting of the output is acceptable.

XHTML 2.0

XHTML 2.0 is a markup language intended for rich, portable web-based applications. While the ancestry of XHTML 2.0 comes from HTML 4, XHTML 1.0, and XHTML 1.1, it is not intended to be backward compatible with its earlier versions. Application developers familiar with its earlier ancestors will be comfortable working with XHTML 2.0. XHTML 2 is a member of the XHTML Family of markup languages. It is an XHTML Host Language as defined in Modularization of XHTML. As such, it is made up of a set of XHTML Modules that together describe the elements and attributes of the language, and their content model. XHTML 2.0 updates many of the modules defined in Modularization of XHTML, and includes the updated versions of all those modules and their semantics. XHTML 2.0 also uses modules from Ruby, XML Events, and XForms.

Ruby: Ruby is the term used for a run of text that is associated with another run of text, referred to as the base text. Ruby text is used to provide a short annotation of the associated base text. It is most often used to provide a reading (pronunciation guide). Ruby annotations are used frequently in Japan in many kinds of publications, including books and magazines. Ruby is also used in China, especially in schoolbooks. Ruby text is usually presented alongside the base text, using a smaller typeface. The name "ruby" in fact originated from the name of the 5.5pt font size in British printing, which is about half the 10pt font size commonly used for normal text. Following figure shows an example, with three ideographs (kanji) as base text, and six hiragana giving the reading (shinkansen - Japanese bullet train).



Ruby text giving the reading of each character of the base text.

East Asian typography has developed various features that do not appear in western typography. Most of these can be addressed appropriately with style sheet languages such as CSS or XSL. However, additional markup is required to define the association between base text and ruby text. This specification defines such markup, designed to be usable with XHTML, so that ruby text is available on the Web without using special workarounds or graphics. Although this specification gives examples of actual rendering to make it easier for most readers to understand the markup, all such examples are informational only. This document does not specify any mechanisms for presentation or styling; this is part of the respective style sheet languages.

XML Events: The XML Events module defined in this specification provides XML languages with the ability to uniformly integrate event listeners and associated event handlers with Document Object Model (DOM) Level 2 event interfaces. The result is to provide an interoperable way of associating behaviors with document-level markup

XForms: XForms has been designed on the basis of several years' experience with HTML forms. HTML Forms have formed the backbone of the e-commerce revolution, and having shown their worth, have also indicated numerous ways they could be improved. The primary difference when comparing XForms with HTML Forms, apart from XForms being in XML, is the separation of the data being collected from the markup of the controls collecting the individual values. By doing this, it not only makes XForms more tractable by making it clear what is being submitted where, it also eases reuse

of forms, since the underlying essential part of a Form is no longer irretrievably bound to the page it is used in. A second major difference is that XForms, while designed to be integrated into XHTML, is no longer restricted only to be a part of that language, but may be integrated into any suitable markup language. XForms has striven to improve authoring, reuse, internationalization, accessibility, usability, and device independence.

2.4.2 Scripting Languages

Scripting languages are performing the role of middleware in mobile commerce application developments. In other terms we can see that the business logic of the application is handled by scripting. Apart from WAP, there are several languages available to an application developer to generate WAP output (WML or XHTML) from other server side languages such as JSP, Perl, PHP, ASP etc. Recently Microsoft introduced an extension to the ASP.NET Framework, which abstracts the WML syntax from the developer and automatically generates the most suitable output for the device used. The proposed model is designed with low cost development and hence chose open source server side language for middleware development. The proposed module is designed through PHP this not only due to free availability PHP. But verities of features are available in PHP language as listed below.

- PHP will run on (almost) any platform. Using the same code base, PHP can be compiled and built on about 25 platforms, including most UNIXs, Windows(95/98/NT/2000) and Macs. As this uses the same code base, all scripts will run identically, whatever the platform.
- PHP is similar to C. So anyone who has experience with a C-style language will soon understand PHP. In C-style languages

we can also include Javascript and Java. In fact, much of PHP's functionality is provided by wrappers around the underlying system calls (such as fread() and strlen()) so C programmers will immediately feel at home.

- PHP is extendible. PHP consists of the core parsing engine (written by Zend), a set of core code modules and then a set of code extensions. This allows programmers two ways of extending PHP to do some special processing, either by writing an extension module and compiling it into the executable, or by creating an executable that can be loaded using PHP's dynamic loading mechanism.
- Lots of HTTP server interfaces. PHP currently will load into Apache, IIS, AOLServer, Roxen and THTTPD. Alternatively, it can be run as a CGI module.
- Lots of database interfaces. PHP currently will work with MySQL, MS SQL, Oracle, Informix, PostgreSQL and many others. These are binary level interfaces, and ODBC is also provided for those situations where the database is not supported.
- And lots of other modules... when a PHP user wants to interface to particular library, then it is easy to write an interface for it, and many have done so, and contributed to the main PHP source repository. The System is enriched with modules for gd library, ffmpeg, graphics routines, PDF files, Flash movies, Cybercash, calendars, XML, IMAP, POP and a host of others. If the library user need is not supported, user can write themselves.
- PEAR. The PHP Extension and Add-on Repository. Similar to the CPAN network for Perl, although still in its infancy, the idea of PEAR is to provide a set of PHP scripts that would be installed by default with the PHP installation

- Fast. PHP is normally used an Apache module and this makes it very fast. It is entirely written in C and is quite small, so loads and executes quickly with small memory footprint.
- PHP is Open Source. Almost a religious matter to some people! In purely practical terms, it means that user are not dependent on a manufacturer to fix things that don't work, nor are user forced to pay for upgrades every year to get a working version.
- Stability: it's no good being fast if the system crashes every few thousand pages. No application is bug free, but having a community of PHP developers and users makes it much harder for bugs to survive for long. Under the hood, PHP uses its own resource management system, and has a sophisticated method for handling variables, making it intrinsically a robust system.
- Security: the system should be protected from malicious attacks from users, both as programmers and as surfers. PHP provides many levels of security which can be set in the .ini file to the desired level.

2.4.3 Other Resources

As proposed model is designed with aim of low cost development the other resources are selected as per best suitability of model architecture. The other resources include operating system, web server to manage the user request and response and it also provide platform of server side script execution and database server to store business data. Recently, another acronym was coined, LAMP, standing for Linux, Apache, MySQL, PHP - now considered an important package in the Internet world, a set of programs that work together to produce dynamic, data-driven applications. LAMP is an acronym used to describe an increasingly popular software

stack, composed of widely-accepted open source application development:

- L = Linux operating system
- A = Apache web server
- M = MySQL database
- P = PHP scripting languages.

Although the components of the LAMP stack were never designed to work together, they have been used for years by an increasing number of developers to create numerous Web sites. The LAMP components are widely distributed and adopted, included at virtually every ISP and bundled with most Linux distributions, including Red Hat and SuSe. LAMP was first used in the late nineties, by Michael Kunze in an article for a German computing magazine. Today, "LAMP" is sometimes used as an umbrella term, representing open source software stacks that are pieced together, as distinct from homogeneous vendor stacks like J2EE or .NET. In the past, LAMP, whether as a whole or as mix-and-match components, was primarily used by large, massively scalable Web sites such as Amazon, Google, Yahoo, and Friendster. Now, LAMP is seeing increasing adoption from enterprise customers. Furthermore, large transactional LAMP applications are already deployed at major companies including Lufthansa, Sabre (Travelocity), Boeing, and Disney. LAMP components are used more and more widely on their own, as well as in LAMP installations. In just the past year, IBM and Oracle endorsed PHP, Sun announced integration of PHP and Java, and Microsoft included Python as a CLR language.

LAMP is singularly focused towards internet applications. The architecture is very straightforward, as illustrated in following figure Linux forwards HTTP connections to Apache, which serves static content directly from the Linux kernel. Dynamic pages are

forwarded by Apache to PHP, which runs the PHP code to design the page. Database queries are sent to MySQL through PHP. Administration is commonly handled through phpMyAdmin, and every major enterprise management system can manage Apache and Linux.

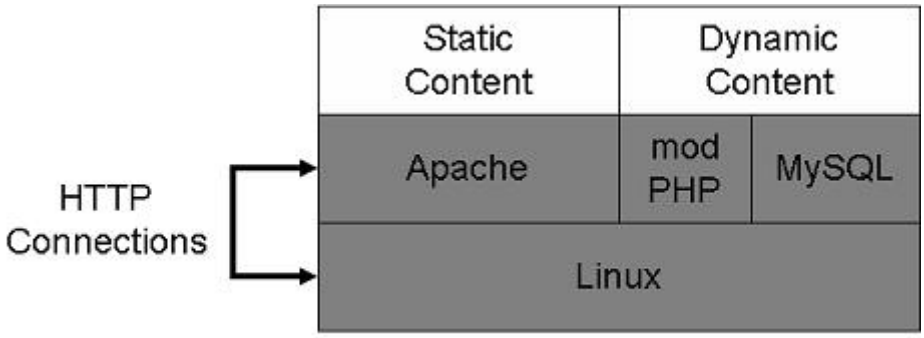


Fig. 2.52 LAMP Architecture

For Web applications, LAMP has been proven faster, cheaper, more flexible, and easier than any alternative. There is a strong push to LAMP by vendors ranging from IBM to Oracle to numerous startups—and these vendors are adding enterprise-grade capabilities and management to LAMP. There is no question that LAMP is not a passing trend, but now entering the mainstream as a serious contender to J2EE and .NET

MySQL (key element of LAMP)

First class database performance, High volume, Scalable within web farms, Easy to maintain, Stable, reliable, dependable, Lowered TCO, Data copied or replicated between servers, Open Source, Integral part of Open Source community from the beginning, Well supported by the other LAMP stack elements, Stability of company-backed Open Source.

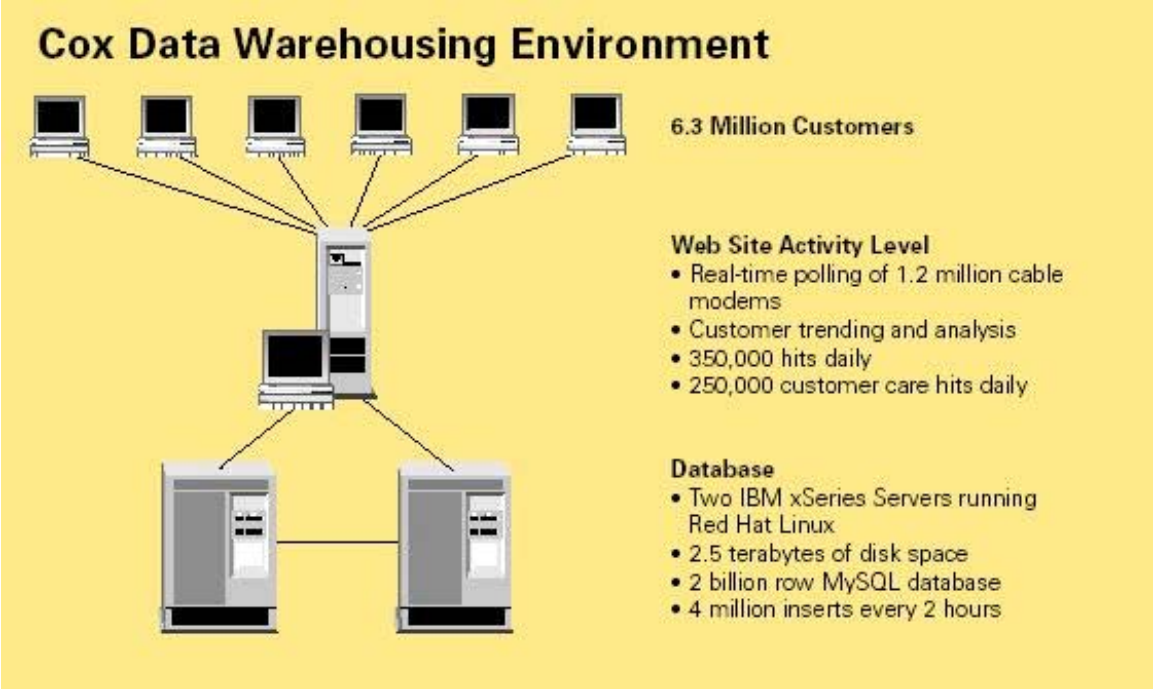


Fig. 2.53 MySQL embed large Enterprise Applications

Above figure shows the ability of MySQL database server to deal with large scale enterprise application. New version of MySQL included Store Procedure, Triggers, Views to develop large scale enterprise application with MySQL database server.

- Stored procedures allow to move business logic from end applications to the MySQL server, which can save effort when multiple end applications (instead of implementing a price calculation routine in PHP for the Web and VC for the desktop, System Administrator can implement it in a stored procedure and call it from both PHP and VC). Stored procedures can also enhance security by allowing System Administrator to prevent a user from accessing a table directly, and, instead, giving them permission to call a stored procedure that has access to the table.

- Triggers are stored routines that are written with syntax like that of stored procedures, but instead of being called by a user or application, triggers are activated by table events such as inserts, updates and deletes. The triggers can modify or abort the triggering table actions, or take the information provided by the action and use it elsewhere. I recently used a trigger to create a MyISAM FULLTEXT lookup table for an InnoDB table: any inserts, updates or deletes to the InnoDB table were mirrored to the lookup table by triggers, and the end users didn't have to change anything about the way they interacted with the InnoDB table.
- Views are, essentially, named virtual tables defined by SQL queries. I can take a complex set of tables, create a SELECT query that might be more meaningful to end users, then turn it into a view. The end users can perform SELECT queries against the view and, in most cases, also execute INSERT, UPDATE and DELETE statements against the view, with the changes being reflected in the underlying tables. Views help to simplify complicated data and also enhance security: as with a stored procedure, System Administrator can create a view and give a user permission to SELECT from the view but not the underlying table.

2.4.4 Tools, SMS Server and Gateway

The research also need wireless equipments to test the application results. It is not possible to purchase all types of wireless devices for testing of application results. But, now a day all vendors are producing SDK (Software Development Kit) which is performing the role of simulators of the devices and help to test the application results with it. Micro browser simulators are typically called as emulators. The research has taken support of such emulators and

software development to achieve device independent application results. The emulators and SDK used in the research are listed below.

- Nokia Development Kit
- WinWAP browser
- Microsoft Mobile Explorer Emulator
- Openwave SDK
- PocketGBA 1.0 Gameboy Advance
- MAMECE MAME Port
- Neopocott NeoGeo Pocket Emulator
- PocketNES NES Emulator
- Phoinix 1.2 Gameboy Emulator
- PalmApple 0.7.5a Apple 2 emulator
- NesEm NES Emulator
- YOSPACE Fullview and HeadView Emulators
- Motorola J2ME SDK
- Sun J2ME Wireless Toolkit
- Siemens Mobility Toolkit

OZEKI SMS SERVER for WINDOWS

Ozeki SMS Server is an efficient tool that makes sending and receiving SMS messages from a computer easy. It uses a GSM phone connected to the PC with a phone-to-pc data cable. The software can be used as a standalone SMS communicator or can be attached to other systems to accomplish automatic messaging as an SMS gateway. The research model uses this server to deliver the business information in SMS. Ozeki SMS Server is a powerful, flexible SMS Gateway application that enables System Administrator to send/receive SMS messages to mobile devices with the computer. It has an easy to use user interface, and an excellent internal architecture. The application can use a GSM mobile phone attached

to the PC with a phone-to-PC data cable or IP SMS technology to transmit and receive the messages. Ozeki SMS server works on Microsoft Windows XP, 2000, 2003 operating systems. The enterprise application can integrate SMS messaging functionality into their publications very easily. Following figure illustrate architecture of SMS server integration with enterprise application.

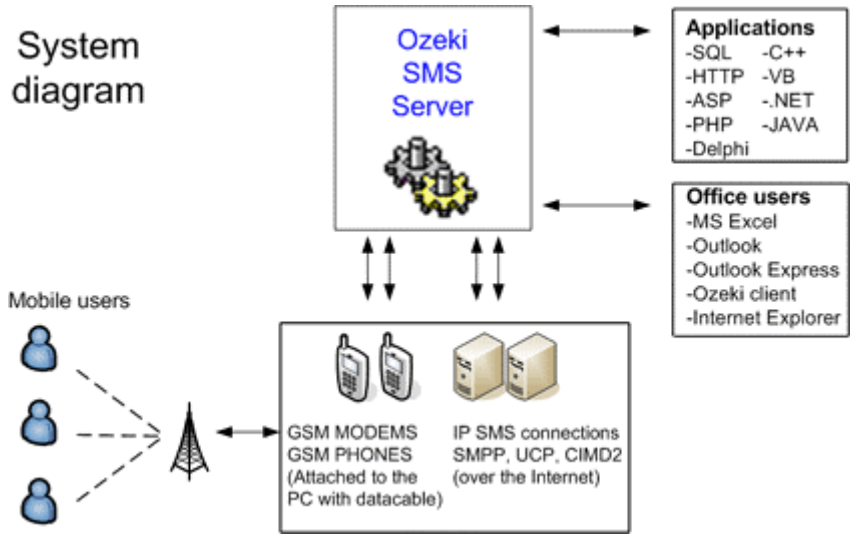


Fig. 2.54 SMS server and Enterprise Application Architecture

If a message needs to be sent, it could be placed into a database table. The Ozeki Message Server monitors this table and delivers the message. The Message Server puts all received SMS in an incoming database table. Many other APIs are available in the software to support software development which provide interface to operate the SMS server through Application.

Now SMS/MMS Gateway

The Now SMS/MMS Gateway (NowSMS) is an SMS and MMS Content Delivery Solution. NowSMS is a fast track to deploying and developing SMS, MMS and WAP Push solutions. NowSMS is an easy-

to-install SMS Gateway, MMS Gateway, WAP Push Proxy Gateway and Multimedia Messaging Center (MMSC) for Windows NT/2000/XP. This gateway is supports following features.

- Supports SMS connectivity via one or more GSM modems (or GSM phones connected to a PC serial port), or over TCP/IP connections using SMPP, UCP/EMI and/or HTTP protocols.
- Supports least cost routing with pattern matching to route messages to different SMS connections based on destination.
- Supports sending and receiving MMS messages either via direct SMS/WAP delivery with its built-in MMSC, or can interface to operator MMSCs using the MM1, MM4 (SMTP), MM7 (XML-SOAP based HTTP POST API) and/or EAIF (Nokia proprietary API) protocols. The MM1 interface can talk to an operator MMSC over a GPRS/GSM modem without a special operator account.
- Supports easy generation and delivery of MMS messages, and includes an MMS compiler for generating the binary headers and message formats required for MMS content.
- Includes a powerful MMSC for processing MMS messages independent of the operator gateway. The MMSC supports dynamic content adaptation and content conversion to help simplify the process of delivering MMS content to devices with varied characteristics. The MMSC also includes a built-in SMTP e-mail gateway for bidirectional exchange of messages between MMS compatible devices and internet e-mail recipients.
- Supports the MM1, MM4, MM7 and EAIF protocols to allow applications and Value Added Service Providers (VASPs) to send and receive MMS messages via the gateway.
- Supports Unicode (UTF-8) formats for both SMS and MMS messages, enabling deployment in multilingual environments.

- Supports easy generation and delivery of WAP Push messages, independent of the WAP gateway being used.
- Supports Multimedia WAP Push to simplify the delivery of multimedia objects and Java applications via WAP Push.
- Supports ("Over The Air") configuration settings and bookmarks, including support for the Open Mobile Alliance (OMA) Provisioning Content v1.1.
- Supports 2-way SMS for interactive application development. SMS messages received by the gateway can trigger either an executable program to be run, or an HTTP request. Simple text responses back to the user can be returned as output of the request. More complex responses, including MMS or other binary SMS content, are also supported.
- Supports 2-way MMS for interactive multimedia application development. MMS messages received by the gateway are parsed into individual file components that can be easily processed by a user supplied tools. For example, received MMS images could be automatically posted to a web site.
- Includes an SMPP server, simplifying the process of connecting multiple gateways and applications.
- Provides an SMTP interface with SMTP Authentication support, allowing a user account to login via SMTP with an e-mail client to submit bulk delivery of SMS or MMS messages.
- Supports sending of other binary SMS formats, including EMS, ring tones, etc.
- Supports concatenated SMS for SMS text messages longer than 160 characters.
- Supports easy generation and delivery of new voice mail notification messages, simplifying the integration of office voice mail with mobile voice mail.

- Supports Open Mobile Alliance Digital Rights Management (OMA DRM) v1.0 with support for forward-lock, combined delivery and separate delivery DRM message types.

3.1 Selection of area for m-commerce model

3.1.1 Examine the need

Thomas Kuhn said that scientific revolutions result from the failure to solve a small problem that appears on the fringes of accepted theory, or from results that do not match expectations. The scientific revolutions that occur from these anomalies "lead the profession at last to... a new basis for the practice of science." It is not possible to define m-commerce or the Internet for that matter, as a "business revolution" because it has not led and does not seem that it will lead, to a "new basis for the practice of business." If we look around, we can see that "Old Economy" businesses are still there. They may have added the Internet and M-Commerce to their business practices, but they are not practicing business in a fundamentally new way. And, with few exceptions, the "pure play" online businesses are still standard businesses, with such old-fashioned things as inventories, staff, and accounting, even if they are all outsourced to someone else. Science and Technology always play key role in improvements of business methodology. To overcome the globalization demand business industries accepted the e-commerce and now-a-days we are getting results. The customer or end users are taking benefit of purchasing the products or services from the business industries through internet backbone on their computing nodes. The e-commerce makes possible user so that user do not need to move at market place for products or services. Even, the user gets benefited from wide range of choices by exploring the World Wide Web.

Information Technology is terminology of computer technology which made possible that user can be able to access the Information from their computers from the globe through Internet.

One another evolutionary area of Technologies is Communication Technology specifically Wireless Communication Technologies. Now-a-days the end user having Wireless devices and they are not only serving communication services. But there are other features that are available in Wireless Communication Devices which facilitate Data interchange in the Wireless Network. The Wireless devices are able to serve the Internet Services through new generation Wireless technologies. The new generation Wireless Technology is ready to serve internet services to various business applications by allowing secure data interchange medium.

This research has taken various business case studies for design of proposed m-commerce business model. The focus of the research is based on extreme need of m-commerce model where the data is rapidly changing every moments and the business potentially needs the information any time and from any where. Among the various application case studies, this research selected the trading application of stock industries for proposed m-commerce business model.

3.1.2 Indian Stock Exchange

Stock exchange is a marketplace where shares can be bought and sold. In other terms Stock Exchange means a body of individuals, whether incorporated or not, constituted for the purpose of assisting, regulating or controlling the business of buying and selling in the securities. In India BSE and NSE are the bodies that are handling the management of stock securities.

Bombay Stock Exchange Limited is the oldest stock exchange in Asia with a rich heritage. Popularly known as "BSE", it was established as "The Native Share & Stock Brokers Association" in

1875. It is the first stock exchange in the country to obtain permanent recognition in 1956 from the Government of India under the Securities Contracts (Regulation) Act, 1956.The Exchange's pivotal and pre-eminent role in the development of the Indian capital market is widely recognized and its index, SENSEX, is tracked worldwide. The Exchange has a nation-wide reach with a presence in 417 cities and towns of India. The systems and processes of the Exchange are designed to safeguard market integrity and enhance transparency in operations. During the year 2004-2005, the trading volumes on the Exchange showed robust growth. The Exchange provides an efficient and transparent market for trading in equity, debt instruments and derivatives. The On Line Trading System (BOLT) is a proprietary system of the Bombay Stock Exchange. The National Stock Exchange of India Limited has genesis in the report of the High Powered Study Group on Establishment of New Stock Exchanges, which recommended promotion of a National Stock Exchange by financial institutions (FIs) to provide access to investors from all across the country on an equal footing. Based on the recommendations, NSE was promoted by leading Financial Institutions at the behest of the Government of India and was incorporated in November 1992 as a tax-paying company unlike other stock exchanges in the country. On its recognition as a stock exchange under the Securities Contracts (Regulation) Act, 1956 in April 1993, NSE commenced operations in the Wholesale Debt Market (WDM) segment in June 1994. The Capital Market (Equities) segment commenced operations in November 1994 and operations in Derivatives segment commenced in June 2000.

The customers or the end user are buying or selling the scripts (securities) through BSE or NSE through brokers. In the traditional system, End user need to move at the place where the brokers

having the BOLT (online trading point) and submit their buy or sell request. Across the globe, developments in information, communication and network technologies have created paradigm shifts in the securities market operations. Technology has enabled organizations to build new sources of competitive advantage, bring about innovations in products and services, and to provide for new business opportunities. Stock exchanges all over the world have realized the potential of IT and have moved over to electronic trading systems, which are cheaper, have wider reach and provide a better mechanism for trade and post trade execution. The end user may able to buy or sale their script through the applications of stock brokers on Internet backbone. For that user need computing node with internet connection to access the application resources. The end user having the new generation wireless technology enabled mobile devices which are able to interchange the data in the internet backbone. If the online trading application extended in such way so that application serves business data interchange to the wireless devices. The user is benefited by getting the information at any time anywhere and also passes the instruction to perform the business transactions on secure medium.

3.2 M-commerce Model generation

The research model is designed and developed for Indian Stock Exchange services. The business model generation model is divided in three step process.

1 Data collection from Stock Exchange and User.
2 Process on Data, meaning full results generation and delivery
3 Business Transactions of user response.

3.2.1 Data collection from Stock Exchange and User

This part of the research is again distributed in two sections. The first section is developed to fetch the security data of National Stock Exchange periodically. And the second section is developed to collect the data from the end user to manage the user's business profile.

3.2.1.1 Security Price Data Collection

The National Stock Exchange is producing the data of security prices of companies listed with the exchange on their stock exchange website www.nseindia.com and the applications which performing the business transactions on behalf of National Stock Exchange. Their certain applications available which received data from Nation Stock Exchange through different protocols with permitted usages.

The research used parsing and text mining method to collect the prices data of different securities from www.nseindia.com. The developed program of research model is using PHP script to parse the data from NSE website. Very first program collected the register securities at Nation Stock Exchange and stored in to MySQL database server at www.mobile4u.co.in. The domain www.mobile4u.co.in is booked to perform the proposed research model activates. The domain is parked at the web server having LAMP (Linux, Apache, PHP, MySQL) environment pre-installed and having ability to produce the WAP content. The other scripts are also developed and uploaded at www.mobile4u.co.in which are responsible to collect the securities prices from NSE website using parsing and text mining techniques with taking support of listed

securities MySQL database at www.mobile4u.co.in and store the data in MySQL database at the same database server.

The web server of www.mobile4u.co.in having features of cron-job as shown in following figure.

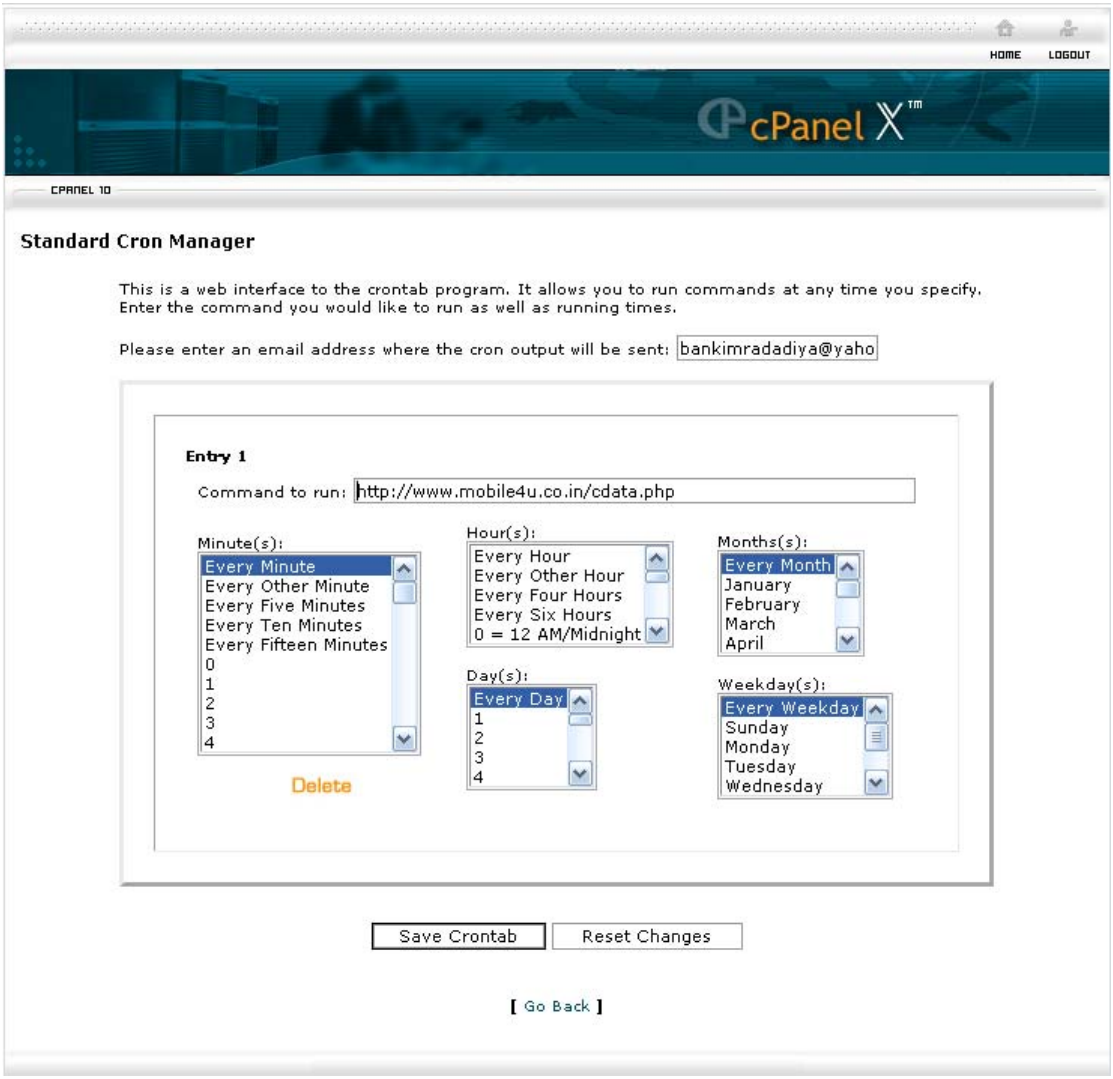


Fig. 3.1 Cron-job tool configuration at www.mobile4u.co.in

This inbuilt tool control panel of web server gives facilities to reparative execution of command or script. The tool is configured to call cdata.php file at one minute time intervals in our model.

cdata.php is PHP file which collect parse the NSE website page through proxy request from www.mobile4u.co.in and collect the pricing and other trade information and stored in to MySQL database. The script is searching the exact data position through buffering the output and separates the data elements.

Note: The parsing method is not feasible solution which may replace in this model in case of XML data availability from National Stock Exchange.

```
<?php

include('config.php');

ob_start();

include('http://www.nseindia.com/marketinfo/equities/quotesearch.
jsp?series=EQ&companyname='.$cname);

$html = ob_get_contents();

ob_end_clean();

$time_start=strpos($html,"As on");

$time_end=strpos($html,"IST");

$time_length=$time_end-$time_start-1;

$pricetime=substr($html,$time_start,$time_length);

$priceblock_start=strpos($html,"Price & Turnover Information");

$priceblock_end=strpos($html,"Intraday price chart");
```

```
$priceblock_length=$priceblock_end-$priceblock_start;

$priceblock=substr($html,$priceblock_start,$priceblock_length);

$priceblock=strip_tags($priceblock,"<td>");

for($i=0;$i<11;$i++)
{
	$p1=strpos($priceblock,">");

	$priceblock=substr($priceblock,$p1+1);

	$p2=strpos($priceblock,"<");

	$result=substr($priceblock,0,$p2);

	$price[$i]=$result;

	if($result=="")
	{

		$i--;

	}
}

$query="insert into rateinfo values('$cname', '$pricetime', $price[6],
$price[2], $price[3], $price[4], $price[0], $price[1], $price[7],
$price[8], $price[9], $price[10])";

mysql_query($query);
```

?>

config.php is the file included in cdata.php which consist the database connection parameter of MySQL server. First, The script is creating the buffer space and then execute nseindia.com script which is generating the security price data. The buffered data is transferred in the string variable and further proceed for parsing. The parsing is the simple process which collects the preposition data in different blocks which separated and transferred MySQL database table. The separated values are Security Name, Time data when the script collect the current price, Last Price of the security, High Price of the security, Low Price of the security, Average Price of the security, Last closed price of the security, Last opened price of the security, change in price from last closed value of security, change in percentage from last closed value of security, Traded quantity of security and Turn over amount of security. The values of these data are the values when the script executed it mean on each periodic execution it collects the different prices information for particular script. The MySQL table structure is shown below where scripts stores the data.

Filed Name	**Filed Type**	**Stored Value**
cname	Text	Security Name
ctime	Text	Time data when the script collect the price data
plast	Float	Last Price of the security
phigh	Float	High Price of the security in the day when the price collected
plow	Float	Low Price of the security in the day when the price collected

pavg	Float	Average Price of the security in the day when the price collected
plclose	Float	Last closed price of the security
popen	Float	Last opened price of the security
pchange	Float	change in price from last closed value of security
ppchange	Float	change in percentage from last closed value of security
tradeqty	Double	Traded quantity of security when price collected
turnover	Double	Turn over amount of security when price collected

The process flow is described in following steps.

Step-1: Ask security list from MySQL
Step-2: The list is send to Script
Step-3: send security name to NSE script
Step-4: NSE response sends to script
Step-5: parsing and data retrieval
Step-6: Data is stored in MySQL
These steps recursively executed until the security found. Following figure shows the flow of script process.

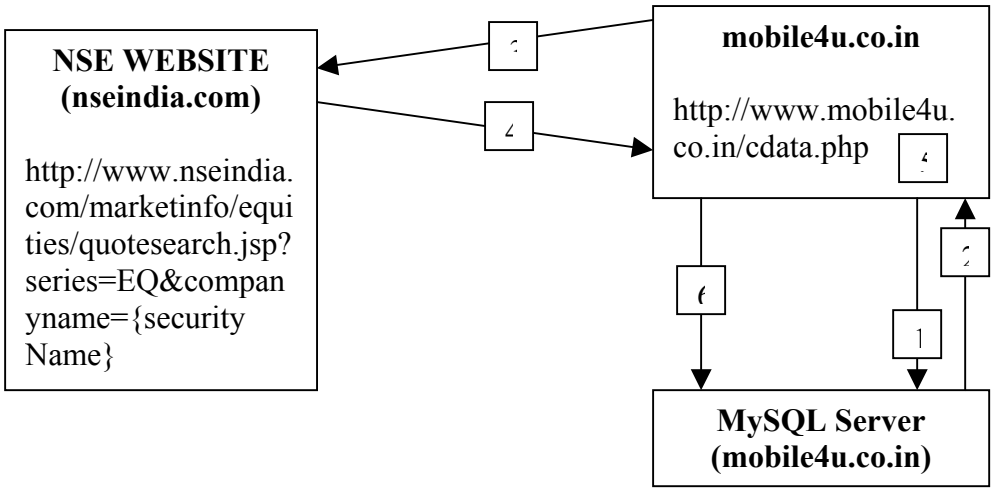


Fig. 3.2 Process flow of Data extraction Script

3.2.1.2 User's Business Profile at www.mobile4u.co.in

This section is developed to collect the user's interest data. The site needed user registration process to access the utilities and profile management. In the registration process it asks user about the personal information and Cell Number for further correspondence. The site also has other utilities which serve user as other Web portal but the features are specifically designed so that it serves the user interest information to authentic members. And all the features are extended to use in Wireless networks.

Function.php

```
<?php
function con($dbhost,$dbuser,$dbpass,$dbdatabase)
{
mysql_connect($dbhost,$dbuser,$dbpass) or die ("MySQL
Connection error".$dbhost." ".$dbuser." ".$dbpass);
```

```
mysql_select_db($dbdatabase) or die ("Wrong MySQL
Database".$dbdatabase);
}
$dbhost="localhost";
$dbuser="root";
$dbpass="";
$dbdatabase="trade";

con($dbhost,$dbuser,$dbpass,$dbdatabase);
?>
```

This script is responsible for MySQL connection. The file is stored at inc directory and called in all the script of the model where the MySQL transaction is going to perform.

template.php

```
<HTML>
<head>
<script language="JavaScript">
window.name='mywin';
</script>
<link REL=stylesheet HREF="./css/mobi.css" TYPE=text/css>
</head>

<body topmargin=0 leftmargin=0 rightmargin=0 bottommargin=0
marginheight=0 marginwidth=0>
<table cellpadding="0" cellspacing="0" align="center" border="0">
<tr>
<td width="*%"></td>
<td width="780">
```

```
<table cellpadding="0" cellspacing="0">
<tr>
<td><img src="./images/head.jpg"></td>
</tr>
<tr>
<td background="./images/bar.jpg" height="28">
<table width="100%">
<tr>
<td><a class="menulink" href="#">MY ACCOUNT</a></td>
<td><a class="menulink" href="myprofile.php">MY
PROFILE</a></td>
<td><a class="menulink" href="#">TOP GAINER</a></td>
<td><a class="menulink" href="#">TOP LOSER</a></td>
<td><a class="menulink" href="#">TIPS OF THE DAY</a></td>
<td><a class="menulink" href="#">CONTACT</a></td>

<td>
<?
if(isset($_SESSION['id']))
{
echo '<a href="logout.php" class="menulink">LOGOUT</A>';
}
else
{
echo '<a href="index.php" class="menulink">LOGIN</A>';

}
?>
</td>
</tr>
</table>
</td>
```

```
</tr>
<tr>
<td><? main(); ?></td>
</tr>
</table>

</td>
<td width="*%"></td>
</tr>
</table>
</body>
</HTML>
```

This script behave as a template of the project where all of the design and structure is written. The main function called in the script will defined in the script which is going to be executed.

Index.php (Home Page)

```
<?
function main()
{
if(isset($_SESSION['usernm']))
{
echo "<script
language='JavaScript'>document.location=main.php;</script>";
}
else
{
include("login.php");
}
}
```

```
include("template.php");
?>
```

login.php (Authentication Page)

```
<html>
<body>
<form action="loginauth.php" method="post">
<BR><BR><BR>
<center>
<TABLE cellSpacing=0 cellPadding=0 height="195">
<TR>
<TD valign="top"><IMG height=5 src="images/m31.gif"
width=177></TD>
</TR>
<TR>
<TD class="myown" height="184" align="center"> <table
border="0" align="center" background="">
<tr>
<td align="center" colspan="2" class="ch11"><FONT
color="#000000">Authentication</font></td>
</tr>
<TR>
<TD align=middle colSpan=2><IMG height=1
src="images/m34.gif"
width=94></TD>
</TR>
<tr>
<td class="ch11" colspan="2"> </td>
</tr>
<tr>
```

```
<td class="ch11" colspan="2"> <FONT
color="#000000">UserName</FONT></td>
</tr>
<tr>
<td colspan="2"> <INPUT class="go1" maxLength=30 value=""
name="user">
</td>
</tr>
<tr>
<td class="ch11" colspan="2"> <FONT
color="#000000">Password</FONT></td>
</tr>
<tr>
<td colspan="2"> <INPUT type=password class="go1"
maxLength=30 name="pass">
</td>
</tr>
<tr>
<td><input name="imageField" type="image"
src="./images/go_menu.gif" border="0"></td>
<td rowspan="3"><img src="images/key.jpg" height="35"
width="24"></td>
</tr>
<tr>
<td><a href="#" class="ml2">Registration</a></td>
</tr>
<tr>
<td><a href="#" class="ml2">Forgot Password</a></td>
</tr>
</table></TD>
</TR>
<TR>
```

```
<TD><IMG height=6 src="images/m33.gif" width=177></TD>
</TR>
</TABLE>
</form>
</body>
</html>
```

Fig. 3.3 Authentication Page

loginauth.php

```
<?php
$host="localhost";
$db="trade";
$c=mysql_connect($host,"root","");
mysql_select_db($db);
$query="select * from login where username='".$user."' and
password='".$pass."'";
$q=mysql_query($query);
```

```
$rs=mysql_fetch_row($q);

global $usernm,$id;
global $ex;
session_start();
session_register("usernm");
session_register("id");

if(isset($rs[0]))
{
$usernm=$user;
$id=$rs[0];
header("Location: main.php");
}
else
{
echo "Username and Password are Invalid!!!";
echo "<br><a href=index.php>Try Again!</a>";
}
?>
```

The users can also update information after login at the site from MY ACCOUNT SECTION. To create the business profile (interest data) user need to login at the web site and then the feature is available in MY PROFILE section. User need to first select the category of trading group. Groups are created by the administrator of the mobile4u.co.in to list the company in classified structure as per the National Stock Exchange Security Groups (Technology, Pharmacy, Cement, Bank ...). The user needs to select the categories of the security as per NSE security categorized classification. When user

select the category it list all the securities comes under that categories.

Main.php

```
<?
function main()
{
echo "<BR>Welcome : <strong> ".$_SESSION['usernm']."
</strong>";
?>
<form action="selcategory.php" method="post">
Select Exchange:
<select name="xx">
<option value="BSE">BSE</option>
<option value="NSE">NSE</option>
</select><br><br>
<input type=submit value="Select" name="select">
</form>
<?
}
include("template.php");
?>
```

Fig. 3.4 Exchange Selection page

Selcategory.php

```
<? session_start();
function main()
{
include("./inc/function.php");
echo "<br><center>";
echo "<table><tr><td>| <a href=addcategory.php>Add more
Category</a> | </td><td><a href=showstatus.php>Show
Status</a> | <a href='main.php'>Back</a>
|</td></tr></table>";
echo "<BR></center>";

$query=mysql_query("select * from category,category_profile
where uid=".$_SESSION['id']." and
category.cid=category_profile.cid");
$query1=mysql_query("select * from category,category_profile
where uid=".$_SESSION['id']." and
category.cid=category_profile.cid");
```

```
$rs1=mysql_fetch_row($query1);
session_register("ech");

if(isset($_POST['xx']))
$ex=$_POST['xx'];

$_SESSION['ech']=$ex;
echo "Welcome : <strong> ".$_SESSION['usernm']." </strong>
";
echo "Exchange :<strong> ".$_SESSION['ech']."
</strong><br><br>";
echo "Your Categories";
echo "<br><br>";
echo "<table width='100%'>";
if(isset($rs1[1]))
{
while($rs=mysql_fetch_row($query))
{
echo "<tr>";
echo "<td width=50>
<a href=ShowCompany.php?cid=$rs[0]&x=$rs[1]><img
src='./images/icon_read.gif' border='0'></a>
</td>
<td width=50>
<a href=delCategory.php?cid=$rs[0]><img src='./images/no.gif'
border='0'></a>
</td>
<td>
". $rs[1] ."
</td>";
echo "</tr>";
}
```

```
}
echo "</table>";
echo "<br>";

}
include("template.php");
?>
```

Fig. 3.5 Selected Categories in user's business profile

delcategory.php

```
<?php
session_start();

$c=mysql_connect("localhost","root","");
```

```
mysql_select_db("trade");
$query=mysql_query("select *from category_profile where uid=".
$id ." and cid=".$cid);
$r=mysql_fetch_row($query);
if(isSet($r[0]))
{
$delete="delete from company_profile where uid=".$id." and
cid=".$cid;
mysql_query($delete);
$delete="delete from category_profile where uid=".$id." and
cid=".$cid;
mysql_query($delete);
}
header("Location: selcategory.php");
?>
```

Addcategory.php

```
<?php session_start();
function main()
{
include("./inc/function.php");

$q=mysql_query("select *from category");
$q1=mysql_query("select *from category");
$r=mysql_fetch_row($q);

if(isSet($r[0]))
{
echo "<BR>Welcome : <strong> ".$_SESSION['usernm']."
</strong><br><br>";
echo "<form action=insertcat.php method=post>";
```

```
echo "<select name=cat>";
while($rs=mysql_fetch_row($q1))
{
echo "<option value='" . $rs[1] ."'>" .$rs[1]."</option>";
}
echo "</select>     <input
type=submit value=Select>";
echo "</form>";
}else
{
echo "There is no category inserted";
}

echo "<br><br><a href=selcategory.php>Back</a>";
}
include("template.php");
?>
```

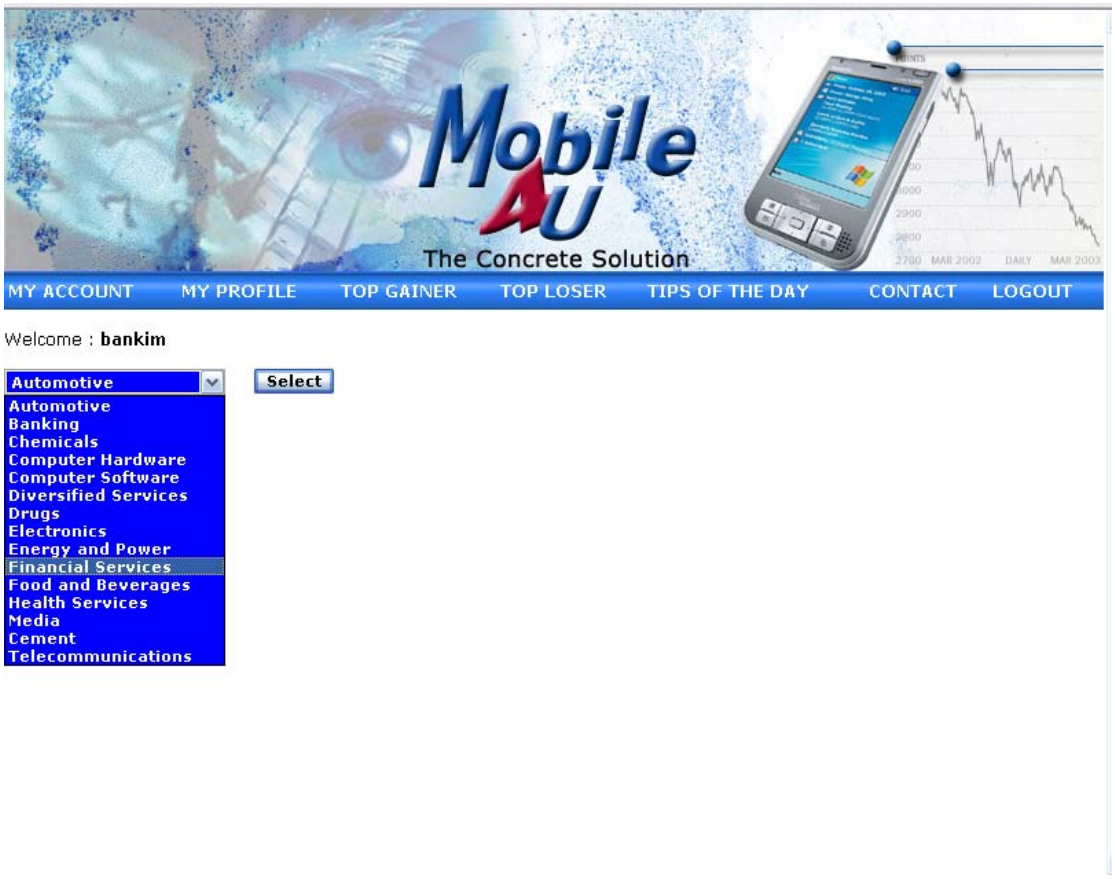


Fig. 3.6 category add page in Profile

Insertcat.php

```
<?php
session_start();
$c=mysql_connect("localhost","root","");
mysql_select_db("trade");

$query=mysql_query("select cid from category where
cname='".$cat."'");
$r=mysql_fetch_row($query);

if(isSet($r[0]))
{
$q="insert into category_profile values(" . $r[0] . "," .$id.")";
mysql_query($q);
header("Location: selcategory.php");
}
?>
```

Showcompany.php

```
<?php       session_start();
function main()
{
include("./inc/function.php");
$query=mysql_query("select cname from category where
cid=".$_GET['cid']."");
$cn=mysql_fetch_row($query);
echo "<center><br>| <a href=selcompany.php?x=$cn[0]>Add
Company</a> | <a href=selcategory.php>Back</a> |</center>";
echo "<BR>Welcome : <strong> ".$_SESSION['usernm']."
</strong>";
```

```
echo "Exchange : <strong> ".$_SESSION['ech']."
</strong><BR><BR>";
echo "$cn[0] Company Details<br><br>";
$q=mysql_query("select
company.comid,company.comcode,company_profile.highval,compa
ny_profile.lowval from company,company_profile where
company_profile.uid=".$_SESSION['id']." and
company_profile.cid=".$_GET['cid']." and
company.comid=company_profile.comid");
$q1=mysql_query("select
company.comid,company.comcode,company_profile.highval,compa
ny_profile.lowval from company,company_profile where
company_profile.uid=".$_SESSION['id']." and
company_profile.cid=".$_GET['cid']." and
company.comid=company_profile.comid");
$r=mysql_fetch_row($q);
if(isSet($r[0]))
{
echo "<table width='100%'>";
echo "<tr>
<th></th>
<th></th>
<th align=left>Company Name</th>
<th align=left><img src='./images/u.gif' border='0'></th>
<th align=left><img src='./images/d.gif' border='0'></th></tr>";

while($rs=mysql_fetch_row($q1))
{
echo "<tr>
<td width=50><a href=editRate.php?comid=$rs[0]><img
src='./images/icon_read.gif' border='0'></a></td>
```

```
<td width=50><a href=delCompany.php?comid=$rs[0]><img
src='./images/no.gif' border='0'></a></td>
<td>" . $rs[1] ."</td>
<td >".$rs[2]."</td>
<td >".$rs[3];
echo "</tr>";
}
echo "</table>";
}
}
include("template.php");
?>
```

Fig. 3.7 Selected Securities (companies) in profile category

Delcompany.php

```
<?php
session_start();

$c=mysql_connect("localhost","root","");
mysql_select_db("trade");

$delete="delete from company_profile where uid=".$id." and
comid=".$comid;
mysql_query($delete);
header("Location: selcategory.php");
?>
```

selcompany.php

```
<?php session_start();
function main()
{
include("./inc/function.php");
$q=mysql_query("select cid from category where
cname='".$_GET['x']."'");
$r=mysql_fetch_row($q);

global $catid;
session_register("catid");

if(isSet($r[0]))
{
$catid=$r[0];

$query=mysql_query("select *from company WHERE cid=".$r[0]);
```

```
$query1=mysql_query("select *from company WHERE cid=".$r[0]);
$rs1=mysql_fetch_row($query1);
echo "<BR>Welcome : <strong> ".$_SESSION['usernm']."
</strong> ";
echo "Add company of <strong>". $_GET['x'] ."</strong>";
echo "<form action=insertcom.php method=post>";

if(isSet($rs1[1]))
{
echo "<select name=comid>";
while($rs=mysql_fetch_row($query))
{
echo "<option value=". $rs[0] .">" .$rs[1]." - ".$rs[2]. "</option>";
}
echo "</select>     <input
type=submit value=ADD>";
}else
{
echo "There is no company inserted";
}
echo "</form>";
}
echo "<br><br><a href=selcategory.php>Back</a>";
}
include("template.php");
?>
```

Fig. 3.8 Company add page in business profile category

Insertcom.php

```
<?php session_start();
function main()
{
include("./inc/function.php");
$q=mysql_query("select * from company where
comid=".$_POST['comid']);
$r=mysql_fetch_row($q);
$cp=mysql_query("select * from company_profile where
comid=".$_POST['comid']." and uid=".$_SESSION['id']);
$cpr=mysql_fetch_row($cp);
if(isset($r[0]))
```

```
{
echo "<br>Company : <strong> $r[1] </strong><BR><BR>";
echo "<form action=setcom.php method=post>";
echo "<table>";
echo "<tr><th>Name<th>Higher<th>Lower";
echo "<tr>";
echo "<td><input type=text name=comnm value='".$r[1]."'>
<input type=hidden name=cid value='".$r[3]."'>
<td><input type=text name=hval size=5 value='".$cpr[1]."'>
<td><input type=text name=lval size=5 value='".$cpr[2]."'>";
echo "</tr>";
echo "</table>";
echo "<BR><input type=submit value=Save>";
echo "</form>";
}
}
include("template.php");
?>
```

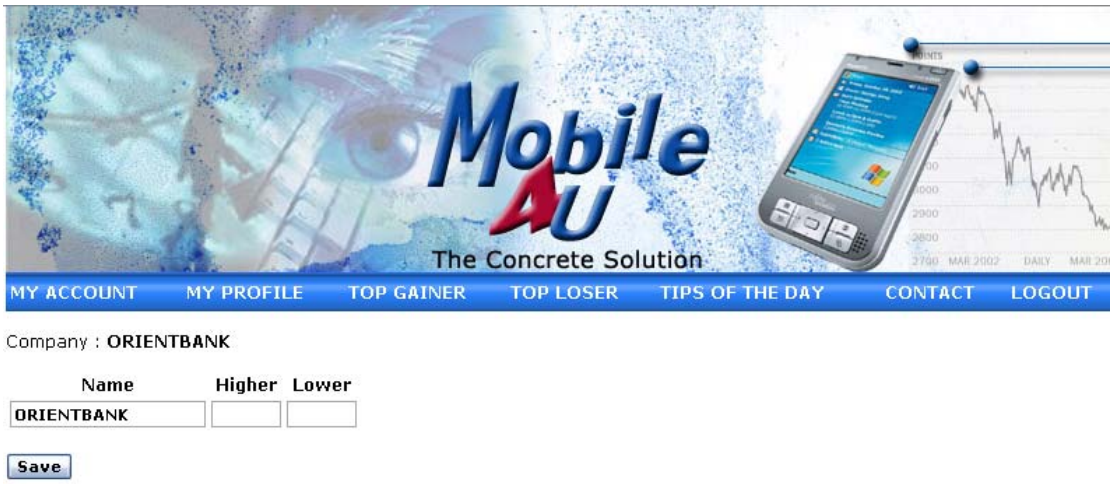


Fig. 3.9 The page to assign the Interest High and Low Rate

Sitcom.php

```
<?
session_start();
$c=mysql_connect("localhost","root","");
mysql_select_db("trade");
$q=mysql_query("select comid from company where comcode='".$_POST['comnm']."'");
$r=mysql_fetch_row($q);
if(isSet($r[0]))
{
$query="insert into company_profile values(".$r[0].",".$hval.",".$lval.",".$id.",".$cid.")";
mysql_query($query);
header("Location: selcategory.php");
}
?>
```

editrate.php

```
<?php session_start();
function main()
{
include("./inc/function.php");
$query=mysql_query("select *from company_profile where uid=".$_SESSION['id']." and comid=".$_GET['comid']);
$q=mysql_query("select *from company where comid=".$_GET['comid']);
$r=mysql_fetch_row($q);
echo "<BR>Welcome : <strong> ".$_SESSION['usernm']." </strong>";
if(isSet($r[0]))
```

```
{
echo " Company : <strong> $r[1] </strong><BR><BR>";

while($rs=mysql_fetch_row($query))
{
echo "<form action=saveRate.php?comid=".$_GET['comid']."
method=post>";
echo "<table>";
echo "<tr><th>Name<th>Higher<th>Lower";
echo "<tr>";
echo "<td>".$r[1]."<td><input type=text name=hval size=5
value=".$rs[1]."><td><input type=text name=lval size=5
value=".$rs[2].">";
echo "</tr>";
echo "</table>";
echo "<BR><input type=submit value=Save>";
echo "</form>";
}
}
echo "<BR><BR><a
href=ShowCompany.php?cid=$r[3]>Back</a>";
}
include("template.php");
?>
```

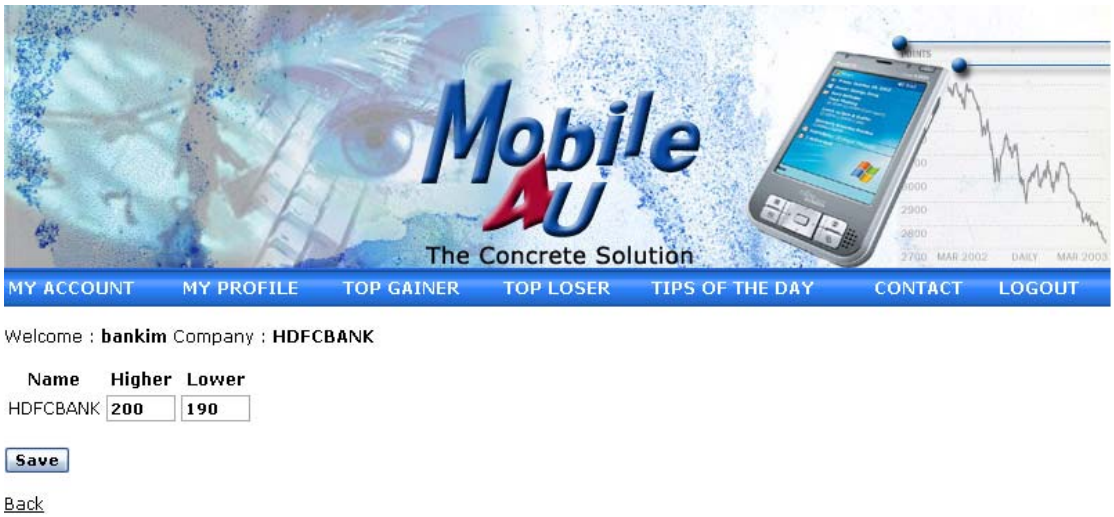


Fig. 3.10 Page to edit interested High and Low prices of existing company

Myprofile.php

```
<?php session_start();
function main()
{
include("./inc/function.php");
echo "<BR>Welcome : <strong> ".$_SESSION['usernm']."
</strong>";
echo "Exchange : <strong> ".$_SESSION['ech'];
$q=mysql_query("select
company.comid,company.comcode,company_profile.highval,compa
ny_profile.lowval from company,company_profile where
company_profile.uid=".$_SESSION['id']." and
company.comid=company_profile.comid");
```

```
$q1=mysql_query("select
company.comid,company.comcode,company_profile.highval,compa
ny_profile.lowval from company,company_profile where
company_profile.uid=".$_SESSION['id']." and
company.comid=company_profile.comid");
$r=mysql_fetch_row($q);

if(isSet($r[0]))
{
echo "<BR><BR><table align=center width=50%>";
echo "<tr><th align=left>Name<th align=left>Higher<th
align=left>Lower</tr>";
while($rs=mysql_fetch_row($q1))
{
//echo "http://r07/trade/rateinfo.php?cname=".$rs[1];
echo "<tr>";
echo "<td><a href=editRate.php?comid=$rs[0]>" .
$rs[1] ."</a><td>".$rs[2]."<td>".$rs[3];
echo "</tr>";
}
echo "</table>";
}
echo "<br><h4 align=center><a
href=selcategory.php>Back</a></h4>";
}
include("template.php");
?>
```

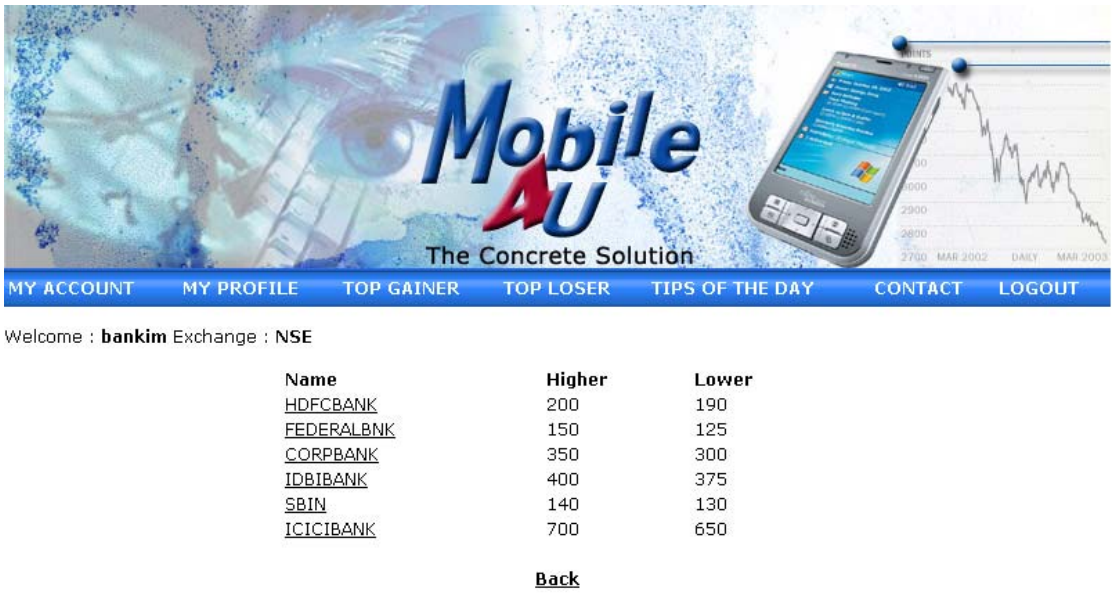


Fig. 3.11 User Profile page

showstatus.php

```
<?php session_start();
function main()
{
include("./inc/function.php");
$q=mysql_query("select * from company_profile where uid=".$_SESSION['id']."");

$q4=mysql_query("select * from login where uid=".$_SESSION['id']."");
$user=mysql_fetch_row($q4);
?>
<BR>
<table width="100%">
<tr>
<td><strong>Company</strong></td>
<td><strong>Heigh value</strong></td>
<td><strong>Low value</strong></td>
```

```
<td><strong>Current Rate</strong></td>
<td><strong>Prapose Action</strong></td>
</tr>
<?php
while($rs=mysql_fetch_row($q))
{
$q2=mysql_query("select * from company where comid=".$rs[0]."");
$cname=mysql_fetch_row($q2);
$q3=mysql_query("select * from rateinfo where cname='".$cname[1]."'");
$crate=mysql_fetch_row($q3);

echo "<tr>";
echo "<td>$cname[2]</td>";
echo "<td>$rs[1]</td>";
echo "<td>$rs[2]</td>";
echo "<td>$crate[2]</td>";
if($crate[2] > $rs[1])
echo "<td>Sale</td>";
elseif($crate[2] < $rs[2])
echo "<td>Purchage</td>";
else
echo "<td>In target</td>";
echo"</tr>";
}
}
include("template.php");
?>
</table>
```

Above scripts and pages shows how to select appropriate security, the portal asks the interest price limits for both the buyers and sellers of the securities. User may set their appropriate interest price limit for any particular security. When user adds the security with interest price limit the script is listed in user's business profile. User may change the interest price any time from MY PROFILE section where it shows the user's selected securities with its interest price rate values. Even user may delete the security from their business profile from the same section.

This script produce the list of user profile as well as it also fetches the current price of the script available in the profile and compare the prices and suggest the decision. It will help user to take decision during creation on the profile. As the mobile application is designed with aim to help user when the desktop computing node is not available with user. But when user is having desktop computing The System may not ignoring the result for that too. So this script will show the list of profile script as well as the proposed action too which will generate by compiling the user's interested high and low rate and current price of the script.

Company	Heigh value	Low value	Current Rate	Prapose Action
HDFC Bank Ltd	200	190	420	Sale
The Federal Bank Ltd	150	125	154.15	Sale
Corporation Bank	350	300	349.05	In target
IDBI Bank Ltd	400	375	62.4	Purchage
State Bank of India	140	130	642.45	Sale
ICICI Bank Ltd	700	650	394.55	Purchage

Fig. 3.12 Profile Status page

The system also facilities TOP GAINER section to view the gainer list which shows the top ten scripts which is gaining on National Stock Exchange. If user is visiting in this section without login, the section list top ten gainers among all the listed securities of National Stock Exchange. If user is visiting in this section after successful login process, the section list top ten gainers from user's business profile scripts.

The system also facilities TOP LOSER section to view the losers list which shows the top ten scripts which is losing on National Stock Exchange. If user is visiting this section without login, the section list top ten losers among all the listed securities of National Stock Exchange. If user is visiting this section after successful login process, the section list top ten losers from user's business profile scripts.

A TIP OF THE DAY is the feature which shows the important five tips generated by the system using previous collected periodic data. The system is showing the TIPS from all the Securities data listed on National Stock Exchange if user visits this section without login in the portal but user get benefited by getting tips from their own business profile if user visits this section after successful login process.

3.2.2 Process on Data, meaning full results generation and delivery

The system having two types of data first is users business profile data which guide system about the user's interest. And the periodic data block which the current price of securities has listed on National Stock Exchange to initiate the process for result discovery.

3.2.2.1 WAP PULL MODEL

The first proposed model stage is to provide the list of securities in wireless devices by keyword search. And it shows the match security list on the wireless device. When user clicks on appropriate securities it will just list the current prices and other information on user's mobile device. After getting the user may send the buying and selling request to the system. The system will keep eye on track of these transactions and pass updates to the back office.

Index.php

```
<?
header("Content-type: text/vnd.wap.wml");
echo "<?xml version=\"1.0\"?>";
echo "<!DOCTYPE wml PUBLIC \"-//WAPFORUM//DTD WML
1.1//EN\"." \"http://www.wapforum.org/DTD/wml_1.1.xml\">";
include("config.php");
include("../wapbuddy_settings.php");
?>
<wml>
<card id="card1" title="m-Trade">
<p mode="nowrap">
<do type="option" label="Home"><go href="../index.php"/></do>
Script Name:<input type="text" name="cname" size="15"/><br/>
<anchor>SUBMIT<go href="getscrip.php" method="post">
<postfield name="cname" value="$cname"/>
</go>
</anchor>
<br/>
<a href="script.php">Search Script Code</a>
</p>
</card>
</wml>
```

The wireless devices show the output as follows.

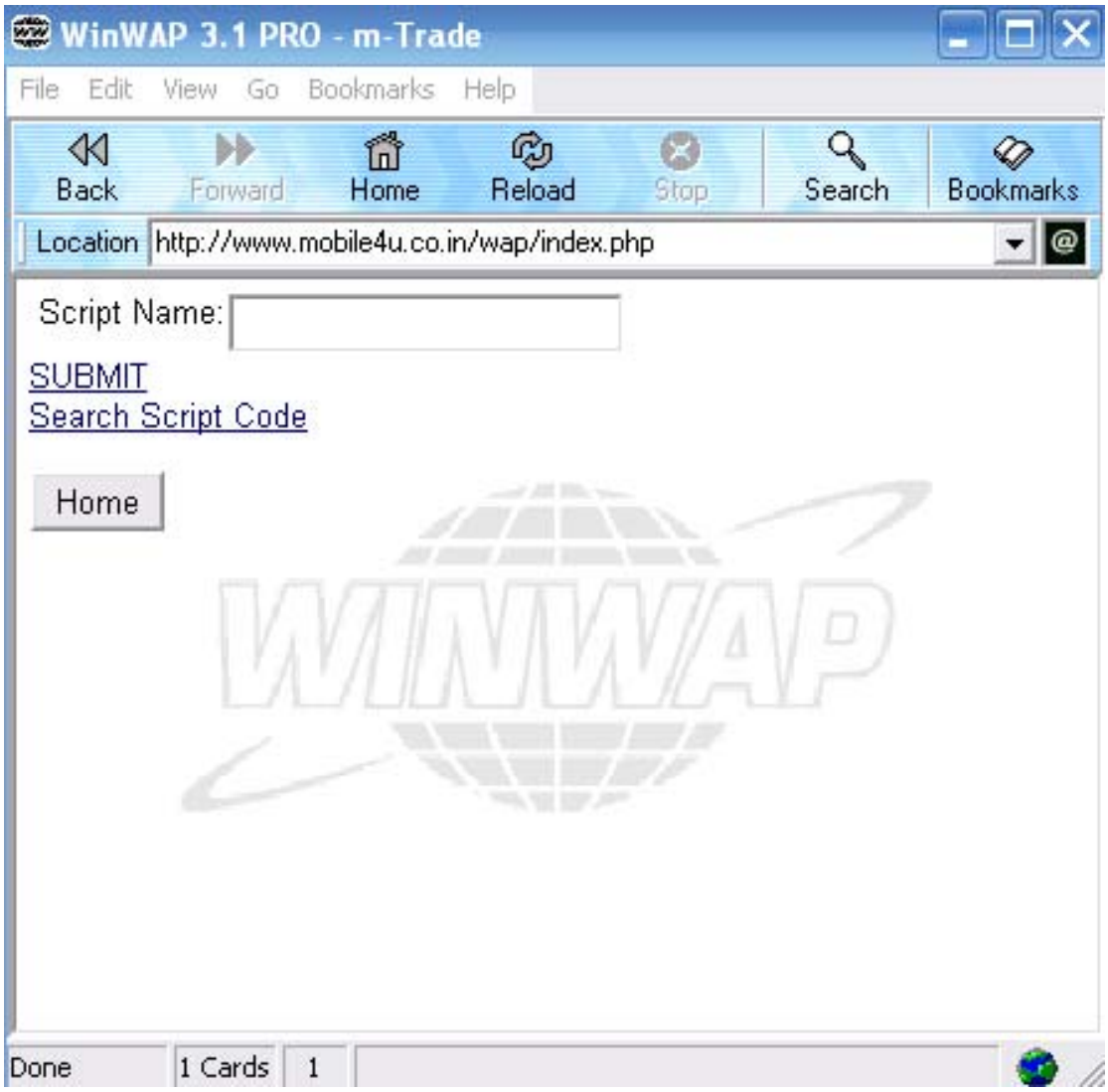


Fig. 3.13 Script code input page in WAP model

getscript.php

```
<?php
include("config.php");
$query="select * from script_list where symbol like '".$cname."'";
$rs=mysql_query($query);
header("Content-type: text/vnd.wap.wml");
echo "<?xml version=\"1.0\"?>";
```

```
echo "<!DOCTYPE wml PUBLIC \"-//WAPFORUM//DTD WML
1.1//EN\"" \"http://www.wapforum.org/DTD/wml_1.1.xml\">";
echo '<wml><card id="card1" title="Result"><p mode="nowrap">';
echo '<table columns="1">';

while($row=mysql_fetch_array($rs))
{
echo '<tr><td>';
echo '<a href="getout.php?cname='.$row['symbol'].'">
'.$row['symbol'].'</a>';
echo '</td></tr>';
}
echo '</table>';
echo '</p></card></wml>';
?>
```

The script will list the securities which match the keyword from National Stock Exchange Securities. And will show the output in the tabular page. The output is shown in following figure.

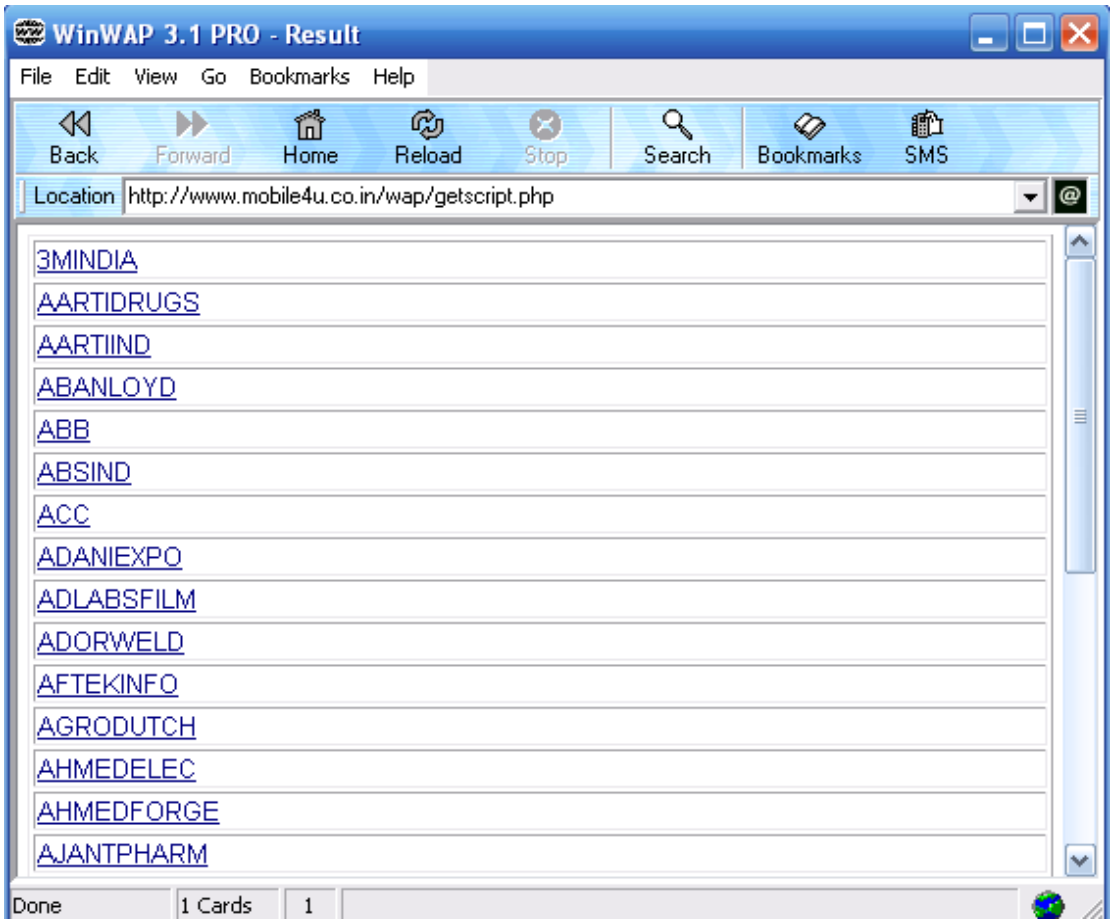


Fig. 3.14 Script list page in WAP model

getout.php

```
<?php
header("Content-type: text/vnd.wap.wml");
echo "<?xml version=\"1.0\"?>";
echo "<!DOCTYPE wml PUBLIC \"-//WAPFORUM//DTD WML
1.1//EN\"" \"http://www.wapforum.org/DTD/wml_1.1.xml\">";

ob_start();
include
'http://www.nseindia.com/marketinfo/equities/quotesearch.jsp?seri
es=EQ&companyname='.$cname;
$html = ob_get_contents();
```

```
ob_end_clean();

$time_start=strpos($html,"As on");
$time_end=strpos($html,"IST");
$time_length=$time_end-$time_start-1;
$pricetime=substr($html,$time_start,$time_length);
$priceblock_start=strpos($html,"Price & Turnover Information");
$priceblock_end=strpos($html,"Intraday price chart");
$priceblock_length=$priceblock_end-$priceblock_start;
$priceblock=substr($html,$priceblock_start,$priceblock_length);
$priceblock=strip_tags($priceblock,"<td>");

for($i=0;$i<11;$i++)
{
	$p1=strpos($priceblock,">");
	$priceblock=substr($priceblock,$p1+1);
	$p2=strpos($priceblock,"<");
	$result=substr($priceblock,0,$p2);
	$price[$i]=$result;
	if($result=="")
	{
		$i--;
	}
}

$pricetbl="<table columns=\"2\">";

 $pricetbl.="<tr>";

 $pricetbl.="<td>";
 $pricetbl.="Last Price";
 $pricetbl.="</td>";
```

```
$pricetbl.="<td>";
$pricetbl.=$price[6];
$pricetbl.="</td>";

$pricetbl.="</tr>";

$pricetbl.="<tr>";

$pricetbl.="<td>";
$pricetbl.="High";
$pricetbl.="</td>";
$pricetbl.="<td>";
$pricetbl.=$price[2];
$pricetbl.="</td>";

$pricetbl.="</tr>";

$pricetbl.="<tr>";

$pricetbl.="<td>";
$pricetbl.="Low";
$pricetbl.="</td>";
$pricetbl.="<td>";
$pricetbl.=$price[3];
$pricetbl.="</td>";

$pricetbl.="</tr>";

$pricetbl.="<tr>";

$pricetbl.="<td>";
$pricetbl.="Average Price";
```

```
$pricetbl.="</td>";
$pricetbl.="<td>";
$pricetbl.=$price[4];
$pricetbl.="</td>";

$pricetbl.="</tr>";

$pricetbl.="<tr>";

$pricetbl.="<td>";
$pricetbl.="Prev. Close";
$pricetbl.="</td>";
$pricetbl.="<td>";
$pricetbl.=$price[0];
$pricetbl.="</td>";

$pricetbl.="</tr>";

$pricetbl.="<tr>";

$pricetbl.="<td>";
$pricetbl.="Open";
$pricetbl.="</td>";
$pricetbl.="<td>";
$pricetbl.=$price[1];
$pricetbl.="</td>";

$pricetbl.="</tr>";

$pricetbl.="<tr>";

$pricetbl.="<td>";
```

```
$pricetbl.="Change from prev close";
$pricetbl.="</td>";
$pricetbl.="<td>";
$pricetbl.=$price[7];
$pricetbl.="</td>";

$pricetbl.="</tr>";

$pricetbl.="<tr>";

$pricetbl.="<td>";
$pricetbl.="% Change from prev close";
$pricetbl.="</td>";
$pricetbl.="<td>";
$pricetbl.=$price[8];
$pricetbl.="</td>";

$pricetbl.="</tr>";

$pricetbl.="<tr>";

$pricetbl.="<td>";
$pricetbl.="Total traded quantity";
$pricetbl.="</td>";
$pricetbl.="<td>";
$pricetbl.=$price[9];
$pricetbl.="</td>";

$pricetbl.="</tr>";

$pricetbl.="<tr>";
```

```
 $pricetbl.="<td>";
 $pricetbl.="Turnover in Rs.Lakhs";
 $pricetbl.="</td>";
 $pricetbl.="<td>";
 $pricetbl.=$price[10];
 $pricetbl.="</td>";
 $pricetbl.="</tr>";

$pricetbl.="<tr><td><a
href='trans.php?trans=b&cname=".$cname."'>BUY</a></td><td>
<a
href='trans.php?trans=s&cname=".$cname."'>SELL</a></td></tr
>";
$pricetbl.="</table>";
echo "<wml> ";
echo "<card id=\"card1\" title=\"Result\">";

        echo "<p mode=\"nowrap\">";
              echo $cname." ".$pricetime;
          echo "<a href=\"index.php\">BACK</a>";
              echo $pricetbl;
        echo "</p>";

echo "</card>";
echo "</wml>";
?>
```

The list is of match securities of user keywords when users clicks any particular list it shows the result with all the current statistics of the security. The statistic values are current price, Last Price of the security, High Price of the security, Low Price of the security, Average Price of the security, Last closed price of the security, Last

opened price of the security, change in price from last closed value of security, change in percentage from last closed value of security, Traded quantity of security and Turn over amount of security. Also it gives the link to initiate the buy and sell process of security. When users click on any of the link it will put the log of transaction at the system and pass it to the back office for actual transaction. The statistic page is shown in following figure.

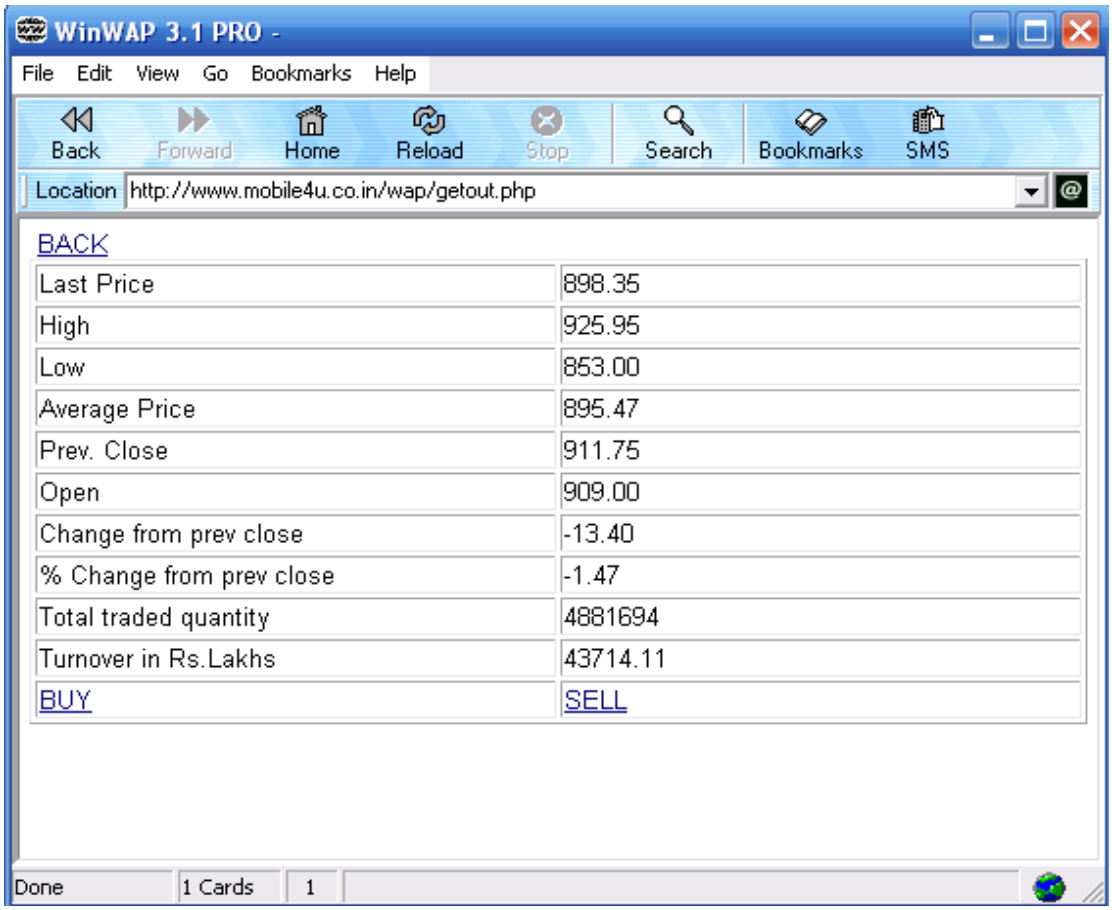


Fig. 3.15 Price result page in WAP model

trans.php

This file send user to login page where system will ask user for authentication values. On successful authentication the transaction is registered and it will pass to back office for actual transaction.

3.2.2.2 SMS PUSH MODEL

One module is needed to develop which periodically awake and compare the user business profile database with security prices database and generates the result sets. The comparison is of the database is performed on interested high price of security and interested low price of security values of business profile database. The comparison algorithm is shown below.

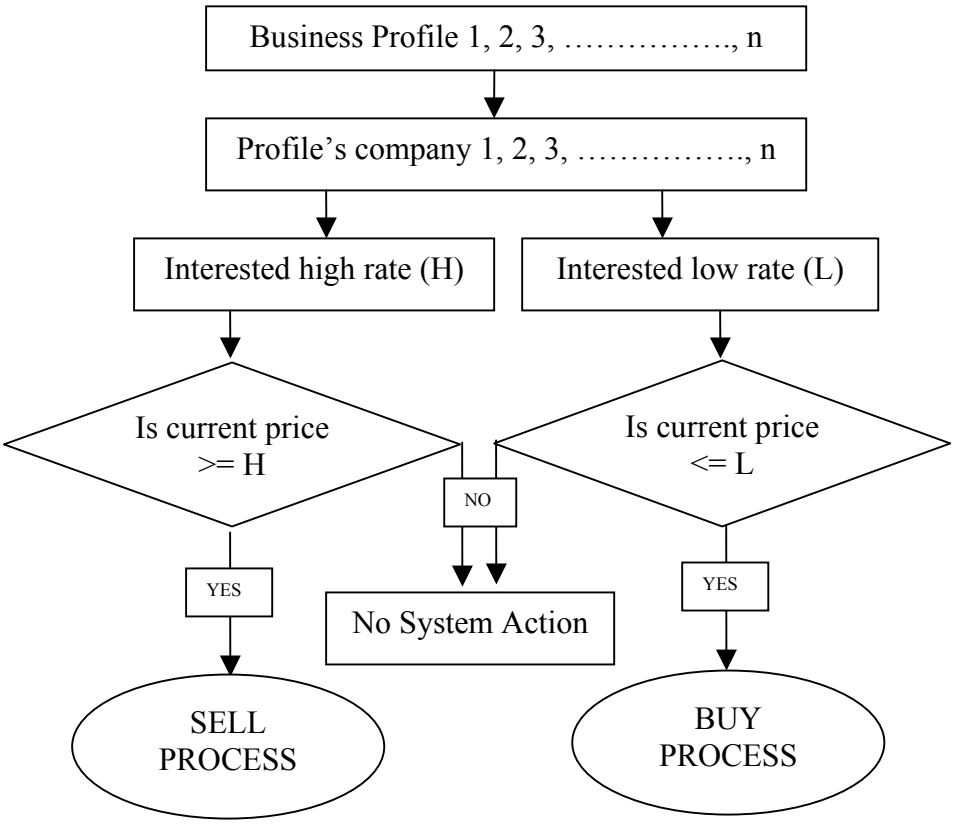


Fig. 3.16 ALERT GENRATION MODEL
(Based on user business Profile And Security Price Information)

The script follows the above algorithm to generate the results. The script performs following steps in execution.

Step-1: Fetches business profiles one by one.

Step-2: Fetches the company one by one from profile.

Step-3: Fetches the interested high rate and low rate from profile

Step-4: It checks that is Interested High rate is grater than or equal to current security price.

Step-5: If the current rate will be higher, than it will generate the Sale alert SMS.

Step-6 It checks current security price rate is less than or equal to interested low rate.

Step-7 If the current rate will be lower, than it will generate the Purchase alert SMS.

Step-8 step-2 process if the other security available in the profile

Step-9 step-1 process of the other user profile is available.

The gensms.php is script performing the SMS message generation process.

Gensms.php

```
<?php session_start();
include("./inc/function.php");
$uq=mysql_query("select * from login");
while($urs=mysql_fetch_row($uq))
{
$q=mysql_query("select * from company_profile where
uid=".$urs[0]);
$q4=mysql_query("select * from login where uid=".$urs[0]);
$user=mysql_fetch_row($q4);
while($rs=mysql_fetch_row($q))
{
```

```
$q2=mysql_query("select * from company where
comid=".$rs[0]."");
$cname=mysql_fetch_row($q2);
$q3=mysql_query("select * from rateinfo where
cname='".$cname[1]."'");
$crate=mysql_fetch_row($q3);

if($crate[2] > $rs[1])
//Sale SMS Block
//The genrated messge transmit to users SMS table
//The SMS number will retrive through $urs[4];

elseif($crate[2] < $rs[2])
//Purchase SMS Block
//The genrated messge transmit to users SMS table
//The SMS number will retrive through $urs[4];
}
}
?>
```

Java based file is used for periodic invocation of gensms.php at remote place the file runs at shell executions. The SMS results are generated at OZEKI SMS server supportive MySQL database. And the API will extract this database and send SMS to user in the form of alert.

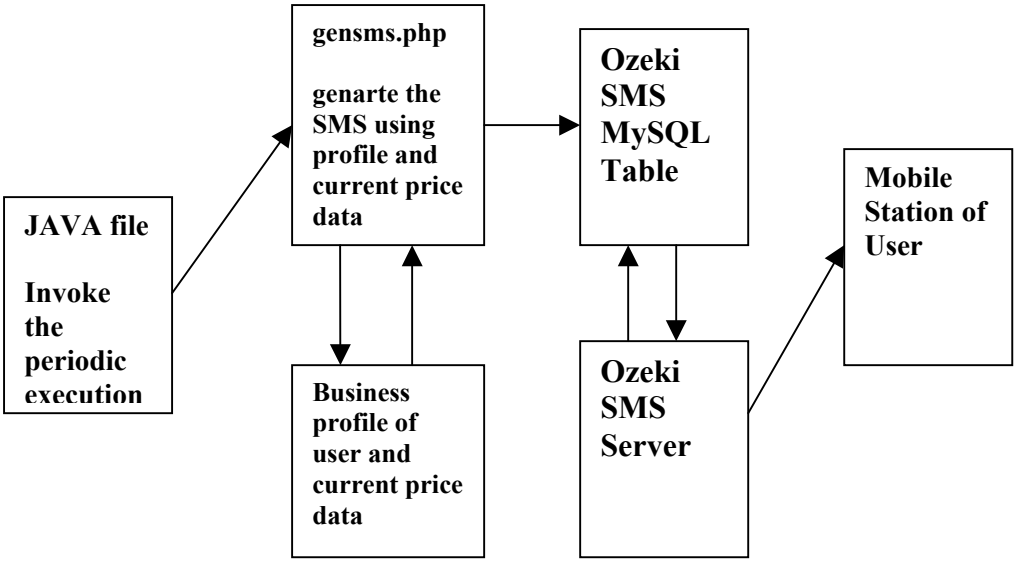


Fig. 3.17 Message Generation and delivery in SMS PUSH

3.2.2.3 WAP Push Model

WAP push is the model the process architecture remains same while the change occurs at the stage of content generation and content delivery. The SMS will only be able to send the limited amount textual data to the end user and it also not allow the multimedia data involvement in the delivery. While MMS which is allowing the multimedia component in the content. MMS is delivered on WAP medium.

The research model is generating the Security charts through historical data comparison of last trend. This will help user to take decision. The chart consist is designed on time vs. rate base statistical data.

As research is aimed of developing the low cost model and the model is running on open source model (LAMP). The proposed model used GD Library for developing historical chart which will passed to user with alerts.

Genmms.php

```
<?php session_start();
include("./inc/function.php");
$uq=mysql_query("select * from login");

while($urs=mysql_fetch_row($uq))
{
$q=mysql_query("select * from company_profile where
uid=".$urs[0]);
$q4=mysql_query("select * from login where uid=".$urs[0]);
$user=mysql_fetch_row($q4);

while($rs=mysql_fetch_row($q))
{
$q2=mysql_query("select * from company where
comid=".$rs[0]."");
$cname=mysql_fetch_row($q2);
$minq3=mysql_query("select min(plast) from rateinfo where
cname='".$cname[1]."'");
$mincrate=mysql_fetch_row($minq3))
$min=$mincrate[0];
$maxq3=mysql_query("select max(plast) from rateinfo where
cname='".$cname[1]."'");
$maxcrate=mysql_fetch_row($maxq3))
$max=$maxcrate[0];
```

```
$q3=mysql_query("select * from rateinfo where
cname='".$cname[1]."' order by ctime desc limit 0,100");
$c=0;
$im = ImageCreate(100,100);
$fgc = ImageColorAllocate($im,255,255,0);
$bgc = ImageColorAllocate($im,255,255,255);
ImageFilledRectangle($im,0,0,100,100,$bgc);

while($crate=mysql_fetch_row($q3))
{
$gvv=$crate[2]-$min;
$gvp=$gvv*100/$max;
ImageFilledRectangle($im,0+$c,0,1+$c,$gvp,$fgc);
$c++;
}

imagegif($im,"./trand/".$cname[1]."_".$urs[0].".gif");
$mmsq="insert into mms values('".$urs[4]."',
'".$cname[1]."_".$urs[0].".gif')";
mysql_query($mmsq);
}
}
?>
```

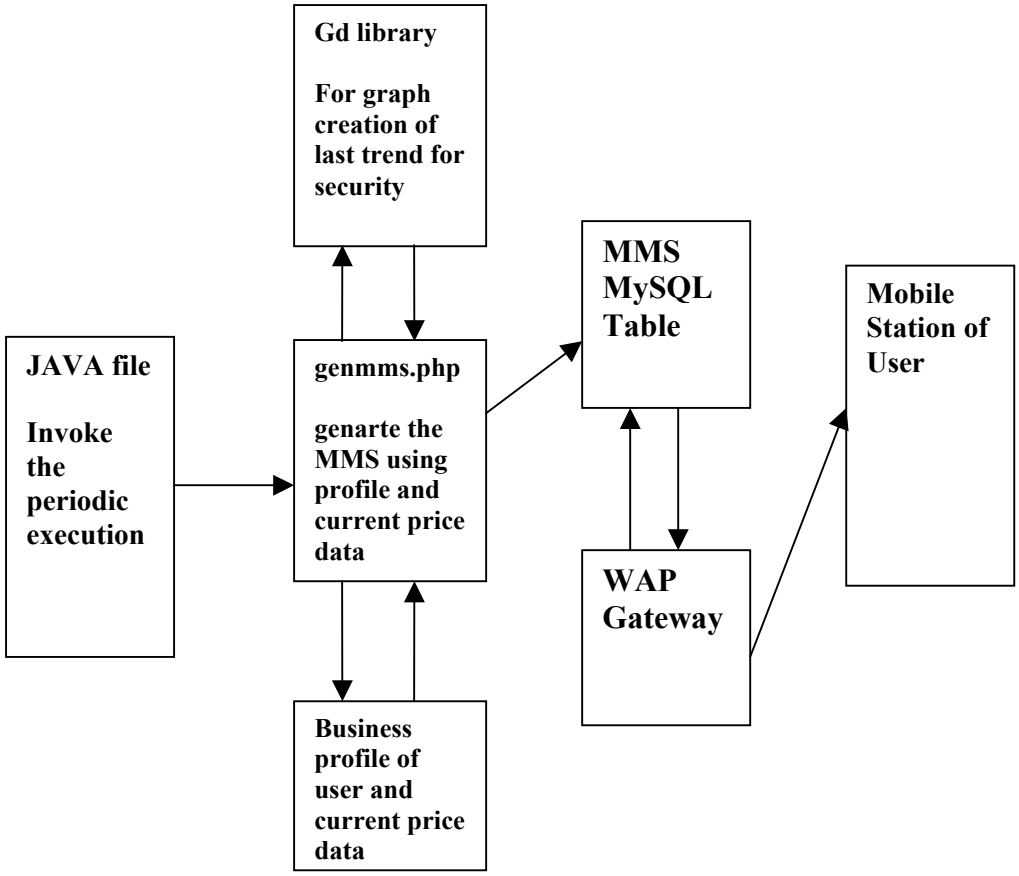


Fig. 3.18 Message Generation and delivery in WAP PUSH

3.2.3 Business Transactions of user response

The user gets alerts which help user to take decision to perform the business transaction. After receiving alerts user will send the response in the form transaction initiations. The message or action sent by the user will be retrieved at the application server. The business logic will pass the message or the action and generate the meaningful trisections and then the transaction is passed to Back office which is responsible to perform the actual transition.

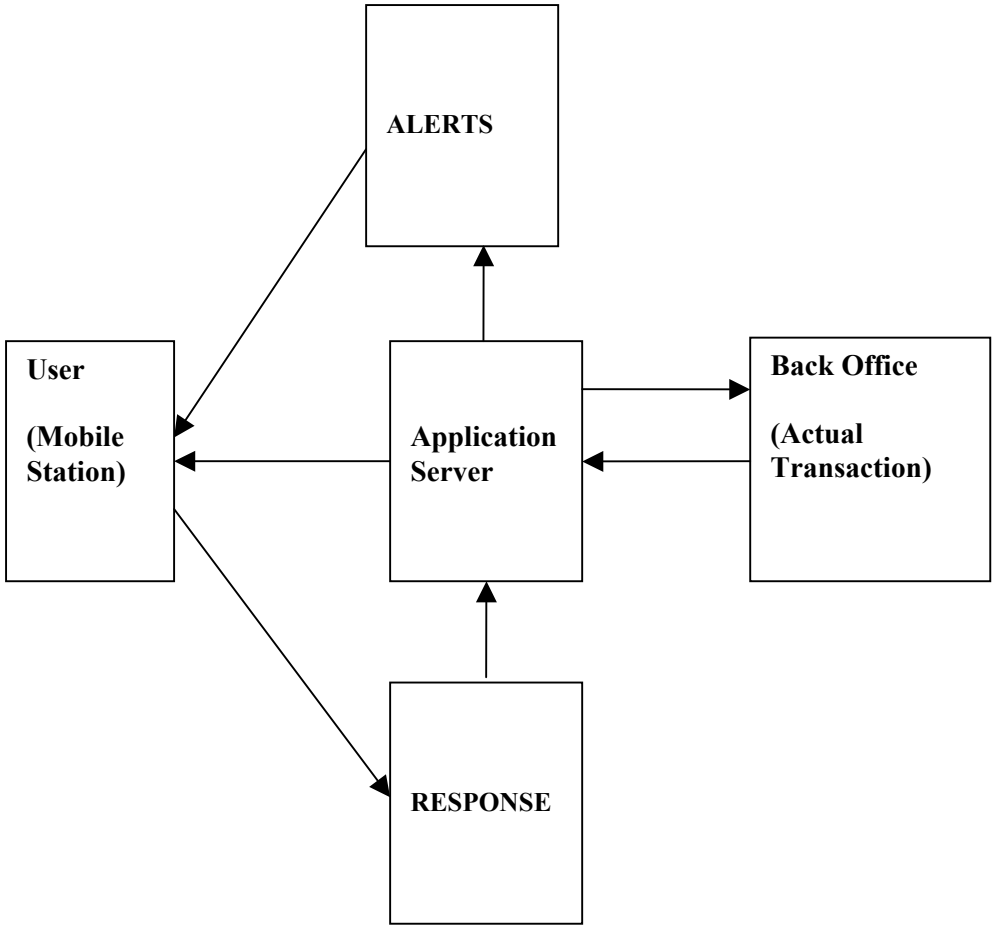


Fig. 3.19 Process Flow between MS, Application server and Back Office

The process flow is work is illustrate in following steps.

1 The application server first generate the alerts
2 The alerts pass to user
3 User respond the alerts through action
4 Application server parse the action and pass transaction to back office
5 Back office perform the transaction and send acknowledgement
6 Application server converts the acknowledgment in the form of message.
7 The message will be sent to user

4.1 Model Implementations

The proposed model architecture is implemented on the live web server with domain www.mobile4u.co.in and the control model is implemented at Research Laboratory of Computer Science Department, Saurashtra University using different languages and tools involved in the fulfillment of the requirements of process architecture.

4.1.1 Pull Model Implementations

The pull model is deployed at live web server with parked domain www.mobile4u.co.in. This domain is booked for the purpose serving Pull request process of the m-commerce model. The web server is having pre configured Apache, PHP and MySQL, also the web server it self running on Linux operating system. In other terms the server is having pre configured LAMP environment for model implementation. The element Apache of LAMP is responsible to accept the Pull request of the user for www.mobile4u.co.in domain. The PHP is responsible for business logic executions and MySQL database server serves the database services in the m-commerce model.

The inbuilt cron-job module is executed at every minute and extracts the securities related information and store in the rateinfo MySQL table of trade database. Following table shows the sample of extracted data. The data is of large amount when it extract periodically. The listed data in following table is just one minute data on time stamp 11th April 05, 16:00:09 of around 100 securities. The lacks of records are extracted during the execution of the cron-job program.

Heading Representation is as under,

Last = Last Security Price

High = High Price till extraction

Low = Low Price till Extraction

AVG = Average price till extraction

L CL = Last Close Price

OP = Opening Price

Change = Change in amount from opening price

P CH = Change in percentages from opening price

T QT = Trade Quantity of Security

TOV = Turn Over in amount

Security Code	Time Stamp	Last	High	Low	AVG	L CL	OP	Change	P CH	T QT	TOV
NTPC	11-APR-05 16:00:09	85.1	86	84.2	84.92	85.85	86	-0.75	-0.87	3114744	2645.04
ACC	11-APR-05 16:00:09	357.25	360	356.25	357.66	361.75	360	-4.5	-1.24	372245	1331.37
ADANIEXPO	11-APR-05 16:00:09	62.85	65.15	62	63.12	64.7	64.7	-1.85	-2.86	483593	305.24
ADLABSFILM	11-APR-05 16:00:09	133.25	135.4	132.5	133.28	134.05	134	-0.8	-0.6	38118	50.8
AHMEDELEC	11-APR-05 16:00:09	127	127.8	125.05	126.59	129.05	126.35	-2.05	-1.59	6313	7.99
ALPSINDUS	11-APR-05 16:00:09	97.3	100.5	96.5	97.9	98.5	100.5	-1.2	-1.22	38003	37.2
AMTEKAUTO	11-APR-05 16:00:09	159.45	160.1	158	159.09	159.95	160.1	-0.5	-0.31	59793	95.12
ANDHRABANK	11-APR-05 16:00:09	105.25	108	104.55	105.7	107.9	108	-2.65	-2.46	743378	785.75
APOLLOHOSP	11-APR-05 16:00:09	336.9	344	331	337.02	341.5	344	-4.6	-1.35	154466	520.58
APOLLOTYRE	11-APR-05 16:00:09	276.6	285.3	272.55	279.63	285.45	285.3	-8.85	-3.1	26593	74.36
ARVINDMILL	11-APR-05 16:00:09	114.95	119.85	113.35	115.79	120.5	119.85	-5.55	-4.61	1362307	1577.42
ASIANPAINT	11-APR-05 16:00:09	392	393	391	391.2	395.4	391	-3.4	-0.86	6376	24.94
ATUL	11-APR-05 16:00:09	77.1	79.75	77.1	78.05	78.9	79.15	-1.8	-2.28	43609	34.04
BAJAJAUTO	11-APR-05 16:00:09	1072.3	1075	1042	1065.14	1055.7	1069	16.6	1.57	46320	493.37
BANKINDIA	11-APR-05 16:00:09	98.25	100	97.3	98.27	99.45	100	-1.2	-1.21	945299	928.95
BANKPUNJAB	11-APR-05 16:00:09	31.65	32.25	30.1	31.54	32.05	31.6	-0.4	-1.25	198345	62.56
BATAINDIA	11-APR-05 16:00:09	96.35	103.65	91.1	98.44	94.2	94.6	2.15	2.28	3420389	3367.03
BHARTI	11-APR-05 16:00:09	208.6	213	206.1	208.77	212.8	212.8	-4.2	-1.97	384844	803.44
BHEL	11-APR-05	784.7	789.	772	781.9	777.	773	7.5	0.97	145	113

	16:00:09		9		8	2				193	5.38
BPCL	11-APR-05 16:00:09	361.1	367.4	360	363.02	364.2	365	-3.1	-0.85	485339	1761.88
BPL	11-APR-05 16:00:09	37.55	38.65	37	37.9	37.25	37	0.3	0.81	100308	38.02
CADILAHC	11-APR-05 16:00:09	451	465	450	453.55	462.5	460.5	-11.5	-2.49	11206	50.82
CENBNK	11-APR-05 16:00:09	14.55	15	14.45	14.63	14.7	14.65	-0.15	-1.02	972637	142.3
CIPLA	11-APR-05 16:00:09	248.65	253.8	247.5	249.21	251.6	253.8	-2.95	-1.17	573262	1428.63
CORPBANK	11-APR-05 16:00:09	349.05	351.75	344.55	347.24	348.35	348	0.7	0.2	5578	19.37
DENABANK	11-APR-05 16:00:09	31.35	32.1	31.2	31.45	31.65	32	-0.3	-0.95	337631	106.18
DRREDDY	11-APR-05 16:00:09	748	753.95	719	745.28	746.1	719	1.9	0.25	59885	446.31
ESSAROIL	11-APR-05 16:00:09	35.2	36.35	35.05	35.54	36.15	36.2	-0.95	-2.63	1719883	611.25
FEDERALBNK	11-APR-05 16:00:09	154.15	157.5	152.5	154.46	156.9	157.5	-2.75	-1.75	69470	107.3
GAIL	11-APR-05 16:00:09	210.8	213.1	208.5	210.72	213.15	213.1	-2.35	-1.1	446592	941.06
GHCL	11-APR-05 16:00:09	46.65	47.5	46.05	46.54	47.45	47	-0.8	-1.69	597459	278.06
GIPCL	11-APR-05 16:00:09	72.1	72.5	71	71.81	72.75	72.5	-0.65	-0.89	47117	33.83
GNFC	11-APR-05 16:00:09	69.3	71.25	68.9	69.56	70.85	71.25	-1.55	-2.19	235006	163.47
GSFC	11-APR-05 16:00:09	113.55	117	112.2	113.71	115.9	117	-2.35	-2.03	161191	183.29
GUJRATGAS	11-APR-05 16:00:09	814	815	800	808	812.15	808	1.85	0.23	10287	83.12
HDFCBANK	11-APR-05 16:00:09	557.05	567.8	545.05	553.54	546.65	567.8	10.4	1.9	208717	1155.33
HEROHONDA	11-APR-05 16:00:09	526.35	536	471	526.69	533.55	531.25	-7.2	-1.35	98524	518.92
HMT	11-APR-05 16:00:09	41	44.5	40.1	42.73	42	44	-1	-2.38	654505	279.67
ICICIBANK	11-APR-05 16:00:09	394.55	406	393.05	397.54	403.95	403.95	-9.4	-2.33	275328	1094.54
IDBIBANK	11-APR-05 16:00:09	62.4	64.35	62	62.68	63.55	64	-1.15	-1.81	125818	78.86
IGS	11-APR-05 16:00:09	248.15	257.5	247.1	251.51	254.1	255	-5.95	-2.34	7474	18.8
INFOSYSTCH	11-APR-05 16:00:09	2077.8	2128	2070.25	2086.47	2127.9	2128	-50.1	-2.35	747290	15591.98
IOC	11-APR-05 16:00:09	452.85	455	448.25	452.4	453.95	454.5	-1.1	-0.24	114377	517.44
IPCL	11-APR-05 16:00:09	167.55	170.65	166.25	167.67	169.65	170.65	-2.1	-1.24	428003	717.63
JINDALSTEL	11-APR-05 16:00:09	1022.5	1036	1015	1021.36	1033.25	1036	-10.75	-1.04	11417	116.61
KOTAKBANK	11-APR-05 16:00:09	332.15	333.7	327	331.18	328.05	328	4.1	1.25	14608	48.38
LUPIN	11-APR-05 16:00:09	552	598.75	545	551.69	572	598.75	-20	-3.5	19734	108.87
MAHABANK	11-APR-05 16:00:09	33.1	33.4	32.65	32.93	33.05	33.4	0.05	0.15	309265	101.84
MARUTI	11-APR-05 16:00:09	402.2	415.4	400.15	406.4	411.5	414.9	-9.3	-2.26	2038229	8283.36
MRF	11-APR-05 16:00:09	2735.7	2776	2725	2745.69	2759.8	2760	-24.1	-0.87	841	23.09
MTNL	11-APR-05	116.2	117.	114	115.6	116.	116.	-0.45	-	472	546.

	16:00:09		5		6	65	5		0.39	599	61
MUKTAARTS	11-APR-05 16:00:09	43.8	45.5	43.5	44.07	45	45.5	-1.2	-2.67	10568	4.66
MYSORECEM	11-APR-05 16:00:09	23	23.7	22.7	23.08	23.35	23.7	-0.35	-1.5	341486	78.81
NDTV	11-APR-05 16:00:09	179.45	184.6	178.1	180.49	185.7	184.5	-6.25	-3.37	72710	131.23
NIRMA	11-APR-05 16:00:09	350.25	363.4	348.1	354.45	360.35	363	-10.1	-2.8	25873	91.71
NTPC	11-APR-05 16:00:09	85	86	84.2	84.92	85.85	86	-0.85	-0.99	3119292	2648.9
ONGC	11-APR-05 16:00:09	875.95	891.2	871	877.95	886.05	891.2	-10.1	-1.14	529345	4647.38
ORIENTBANK	11-APR-05 16:00:09	302.55	309.9	301.55	304.94	304.85	309.9	-2.3	-0.75	643013	1960.8
PATELENG	11-APR-05 16:00:09	203.5	213	203.5	206.64	214.2	213	-10.7	-5	10783	22.28
PATNI	11-APR-05 16:00:09	349.15	359	348.3	349.77	357.15	359	-8	-2.24	190562	666.53
PNB	11-APR-05 16:00:09	389.3	391.45	382	388.11	381.6	383	7.7	2.02	2308356	8958.96
RANBAXY	11-APR-05 16:00:09	990	1002.1	970	986.58	978.75	980	11.25	1.15	286420	2825.76
RAYMOND	11-APR-05 16:00:09	325.5	333.95	323.2	326.86	335.6	330	-10.1	-3.01	43023	140.62
SANDESH	11-APR-05 16:00:09	121.25	125.6	121.15	122.68	126.35	125.6	-5.1	-4.04	2389	2.93
SAREGAMA	11-APR-05 16:00:09	120.45	128.3	118.85	122.32	116.6	123.4	3.85	3.3	155777	190.55
SATYAMCOMP	11-APR-05 16:00:09	400.8	412	398.5	402.59	411.75	410.1	-10.95	-2.66	3043312	12252.07
SAVITACHEM	11-APR-05 16:00:09	251.95	254	246.95	250.68	246.75	247	5.2	2.11	6193	15.52
SBIN	11-APR-05 16:00:09	642.45	659	640.1	645.83	653.15	653.15	-10.7	-1.64	1597727	10318.6
SCANDENT	11-APR-05 16:00:09	186.6	194.4	185.6	190.32	192.4	192	-5.8	-3.01	59829	113.87
SCI	11-APR-05 16:00:09	155.45	157.2	153.2	155.31	155.05	155.8	0.4	0.26	365020	566.91
SESAGOA	11-APR-05 16:00:09	730.25	743.7	725.5	733.44	730	732	0.25	0.03	576719	4229.89
SHASUNCHEM	11-APR-05 16:00:09	362.7	367	352.2	362.3	366.85	365.05	-4.15	-1.13	2625	9.51
SHREECEM	11-APR-05 16:00:09	335.9	343.5	333.75	335.27	340.6	343.5	-4.7	-1.38	4260	14.28
SHRMHONDA	11-APR-05 16:00:09	141.75	142.5	135.1	135.89	136	138	5.75	4.23	29450	40.02
SICAL	11-APR-05 16:00:09	107.4	108.5	101.45	104.14	106.75	104.3	0.65	0.61	26112	27.19
SIEMENS	11-APR-05 16:00:09	1710.9	1715	1675	1695.83	1678.7	1675	32.2	1.92	9416	159.68
TATACHEM	11-APR-05 16:00:09	153.05	156.8	151.1	153.19	155.4	156	-2.35	-1.51	154960	237.38
TATAINFOTE	11-APR-05 16:00:09	518.75	549.95	515	532.94	535.7	549.95	-16.95	-3.16	9541	50.85
TATAMOTORS	11-APR-05 16:00:09	418.9	429.3	413.1	422.97	422.7	415	-3.8	-0.9	2536954	10730.55
TATAPOWER	11-APR-05 16:00:09	340.85	344.9	337.1	340.56	341.95	344.9	-1.1	-0.32	338170	1151.67
TATATEA	11-APR-05 16:00:09	524.5	529	521	524.04	528.8	529	-4.3	-0.81	32126	168.35
TATAVASHI	11-APR-05	12.65	12.8	12.45	12.6	12.9	12.5	-0.25	-	341	4.3

S	16:00:09								1.94	40	
TCS	11-APR-05 16:00:09	1363.6	1400	1360.1	1369.93	1393.55	1397	-29.95	-2.15	352874	4834.13
TEXMACOLTD	11-APR-05 16:00:09	295	300	295	297.32	300.55	300	-5.55	-1.85	3916	11.64
THERMAX	11-APR-05 16:00:09	638.65	644.9	622	636.67	637	637	1.65	0.26	9720	61.88
THOMASCOOK	11-APR-05 16:00:09	442.1	445	435	440.64	437.85	438.9	4.25	0.97	4430	19.52
TISCO	11-APR-05 16:00:09	381.3	386.7	375.25	379.14	381.05	382.9	0.25	0.07	4116245	15606.33
TITAN	11-APR-05 16:00:09	231.2	242.4	229	232.83	241.45	242.4	-10.25	-4.25	202813	472.21
TORNTPHARM	11-APR-05 16:00:09	460	460	432.1	451.98	452.3	433	7.7	1.7	4181	18.9
TUBEINVEST	11-APR-05 16:00:09	297.8	305	291.2	296.66	303.05	305	-5.25	-1.73	3291	9.76
TV18	11-APR-05 16:00:09	201.35	202.5	201	201.45	199.4	201.5	1.95	0.98	14333	28.87
TVSMOTOR	11-APR-05 16:00:09	70.2	70.9	69.45	69.86	69.55	69.75	0.65	0.93	101492	70.9
TVTODAY	11-APR-05 16:00:09	76.9	79.4	76.5	77.26	78.55	79	-1.65	-2.1	43642	33.72
UCALFUEL	11-APR-05 16:00:09	190.55	199	190	193.1	194.75	199	-4.2	-2.16	17504	33.8
UCOBANK	11-APR-05 16:00:09	30.15	30.9	29.85	30.17	30.7	30.4	-0.55	-1.79	946475	285.55
ULTRACEMCO	11-APR-05 16:00:09	355.5	355.5	350.25	352.5	353.2	352	2.3	0.65	14580	51.39
UNICHEMLAB	11-APR-05 16:00:09	191.05	198.4	190.2	195.27	196	198.4	-4.95	-2.53	18278	35.69
UNIONBANK	11-APR-05 16:00:09	107.85	110.25	106.8	108.21	110.15	110	-2.3	-2.09	503897	545.27
UNIPHOS	11-APR-05 16:00:09	720	729.85	710	721.13	718	710	2	0.28	13999	100.95
UNITECH	11-APR-05 16:00:09	322.7	331.2	318	324.75	324.1	323	-1.4	-0.43	846	2.75

In the testing process of the developed m-commerce model research has included around securities. However, ever the extension of adding more securities is feasible in the model. The model test the extraction process of the price data for a month time period during trading hours of National Stock Exchange and collected the periodic data on regular minute intervals of pre defined securities of m-commerce model. During the extraction process research also generated the pull request to www.mobile4u.co.in through 50 business profile registered at www.mobile4u.co.in. The number of students groups, research scholars and other users and business personality supports to generate simultaneous request on regular intervals to test the process efficiency of the m-commerce model. The different

securities from different stock groups categories are already added in predefine 50 business profiles before making pull request to the portal www.mobile4u.co.in.

4.1.2 Push Model Implementations

In the case of Pull model the user who has registered their profile with www.mobile4u.co.in need to check the profile status to take the decision for making business transactions after watching the current trends. When the user is accessing the information from their pervasive device the device is battery powered and low processing power as well as the process will take time to rich the pull request through wireless network backbone and internet backbone. To reduce the processing power, battery utilizations and process time the next push model comes in the picture as next face of m-commerce model generation.

4.1.2.1 SMS Implementation

The SMS Push model uses the same extracted data which are generated at www.mobile4u.co.in for serving information in WAP pull model. As well as the same 50 users business profile is used to generate the mining full alerts of the ongoing trends. The model implantation also use OZEKI SMS server tool for delivery of the alerts and also to mange the user's decision comes in the form of SMS response. OZEKI SMS server tool also provides the APIs which helping the application by providing interfaces between Application and OZEKI SMS Server. In research model the OZEKI SMS server is configured at Research Laboratory of Computer Science Department, Saurashtra University. It also supports the SMS management with MySQL database tables through predefined APIs available in the tools. The research model used the MySQL tables for SMS alerts

management and collections of users response. Also OZEKI SMS server supports various languages to interact with OZEKI SMS server.

OZEKI SMS Server Configuration

The OZEKI SMS server is configured with following architecture in research Laboratory. Where, GSM Phone facilities the connection between application server and GSM Network.

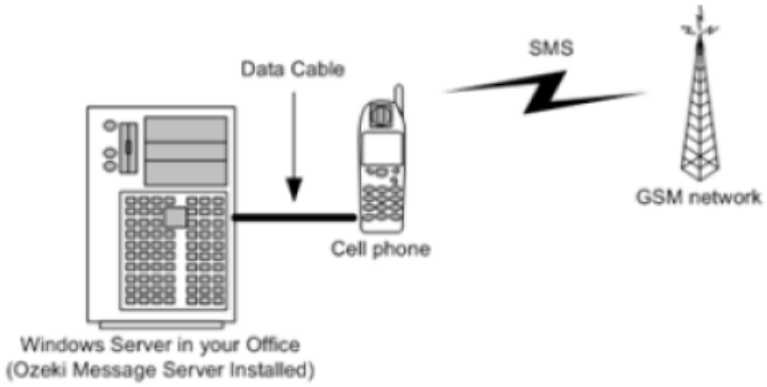


Fig. 4.1 Wireless connectivity for OZEKI in Research Model

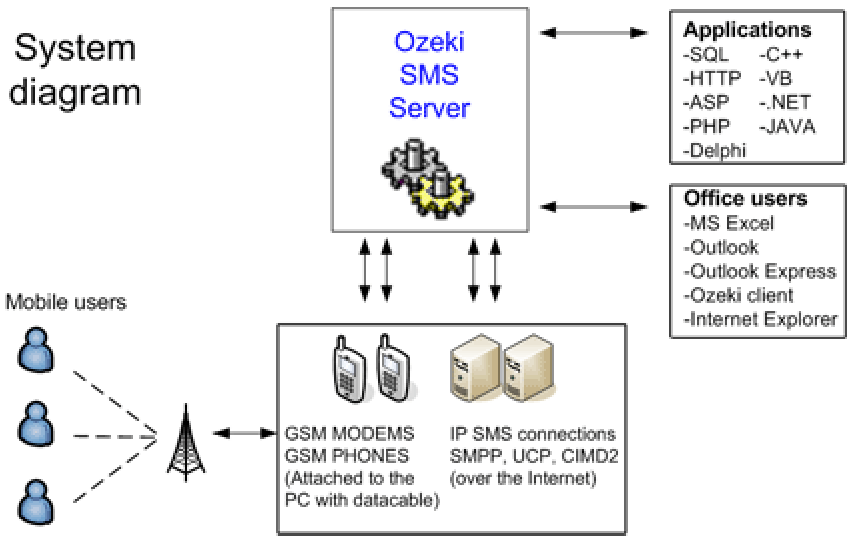


Fig. 4.2 architecture of the OZEKI at application

The OZEKI server needs to configure with wireless connectivity node. In this model Wireless Mobile Device is choosen as a connectivity node which needs to be configured with perimeters like operator Name and mobile device number, message center number and COM PORT where the device is connected through cable.

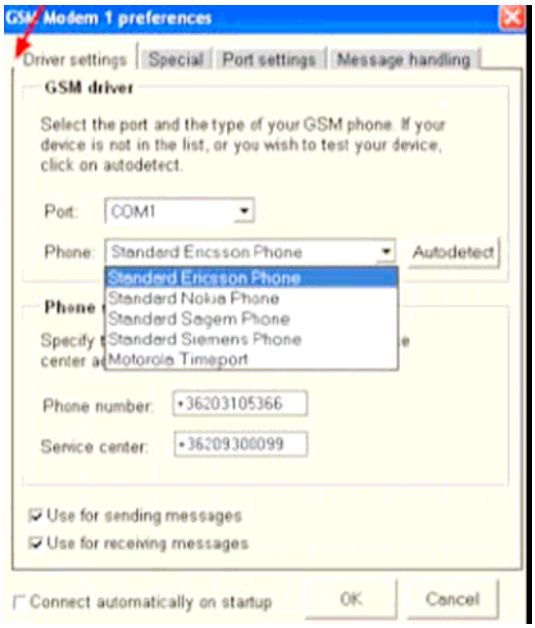


Fig. 4.3 SMS server configuration – 1

After configuring the parameters make it connected.

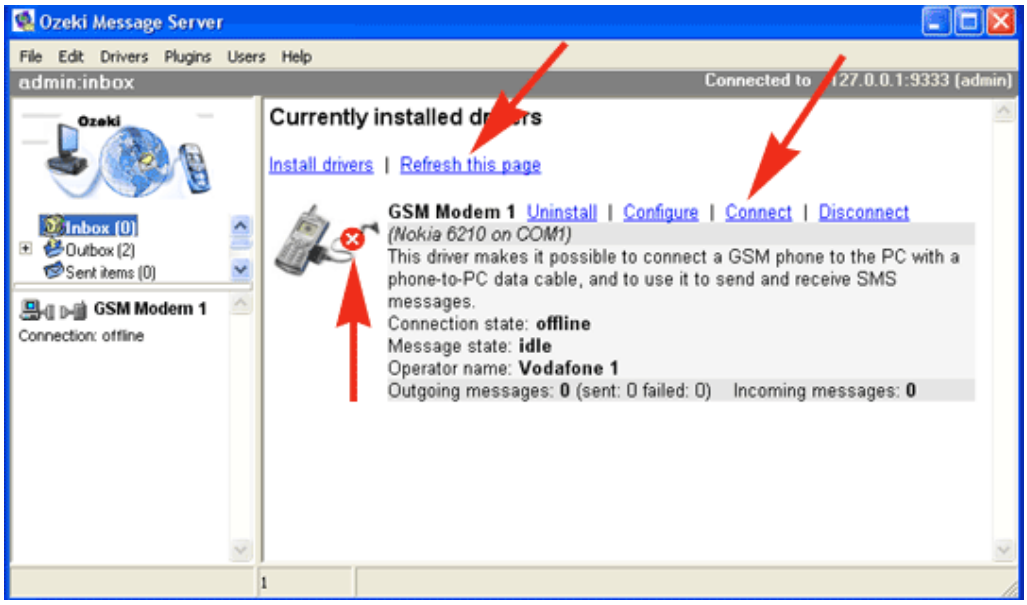


Fig. 4.4 SMS server configuration – 2

Fig. 4.5 Message Handling Parameters (message memory, delay ...) in SMS server

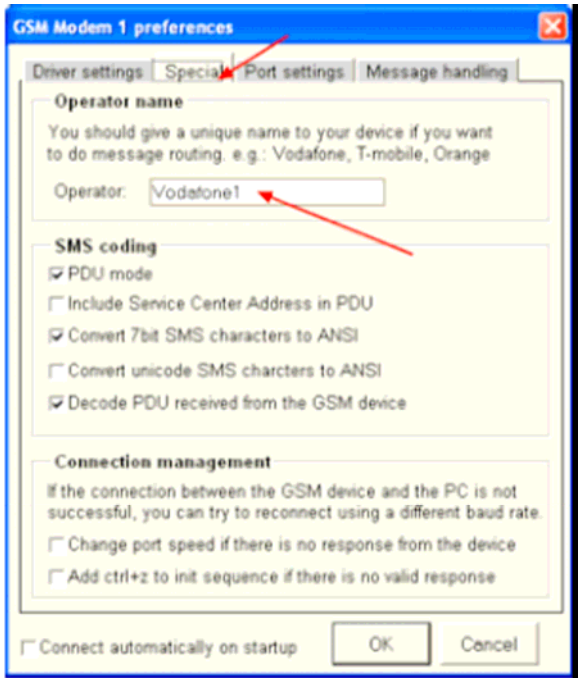


Fig. 4.6 Special Configuration Parameters in SMS Server

OZEKI SMS SERVER and Application embedding architecture

The research model has placed the OZEKI SMS Server with application with PHP and MySQL API Support. The following figure illustrates this architecture. In research model the application is designed through PHP while the MySQL is used as a database server.

Fig. 4.7 Research m-commerce MODEL with OZEKI tool

These architecture also shows the result, when the application and the database server is embed with the OZEKI SMS server. The database server is behaving as the gateway of Incoming and outgoing SMS route is specified from MySQL tables by application.

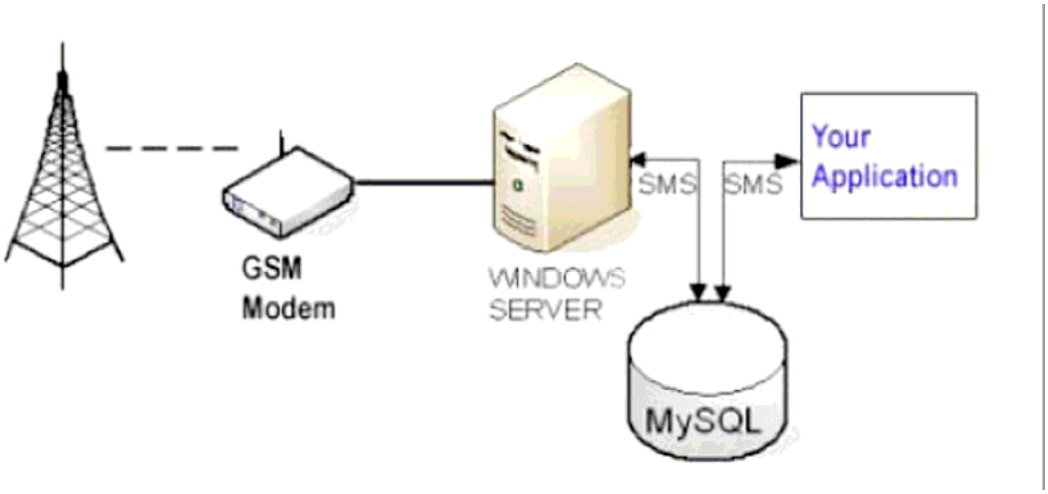


Fig. 4.8 MySQL behave as a SMS gateway

Configure MySQL tables to make it as compatible as SMS gateway

Very first the need is to design the table where the tool stores the incoming and outgoing messages. As per the API specification the suggested table structures are as follows.

OZEKIsmsin

Field	Type	Attributes	Null	Default	Extra
id	int(11)		No		auto_increment
sender	varchar(30)		Yes	*NULL*	
receiver	varchar(30)		Yes	*NULL*	
msg	varchar(160)		Yes	*NULL*	
senttime	varchar(100)		Yes	*NULL*	
receivedtime	varchar(100)		Yes	*NULL*	
operator	varchar(100)		Yes	*NULL*	

OZEKIsmsout

Field	Type	Attributes	Null	Default	Extra
id	int(11)		No		auto_increment
sender	varchar(30)		Yes	*NULL*	
receiver	varchar(30)		Yes	*NULL*	
msg	varchar(160)		Yes	*NULL*	
senttime	varchar(100)		Yes	*NULL*	
receivedtime	varchar(100)		Yes	*NULL*	
status	varchar(20)		Yes	*NULL*	
operator	varchar(100)		Yes	*NULL*	

After creation of the database table, users need to be created with appropriate privileges. This user has to be able to log in to the database from the Windows PC and should have privileges for selecting and inserting records into the newly created tables. The next step is of Configuration of ODBC data source. It is configured from Control Panel and then Administrative Tools section with option available with title Data Source (ODBC).

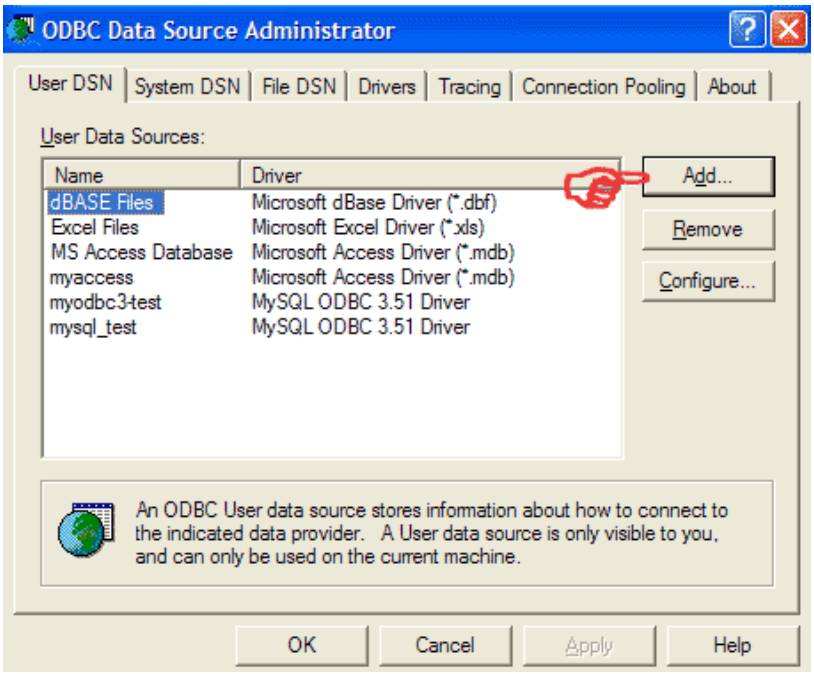


Fig. 4.9 MySQL APIs configuration in SMS Server – 1

click on Add as shown in the figure above.

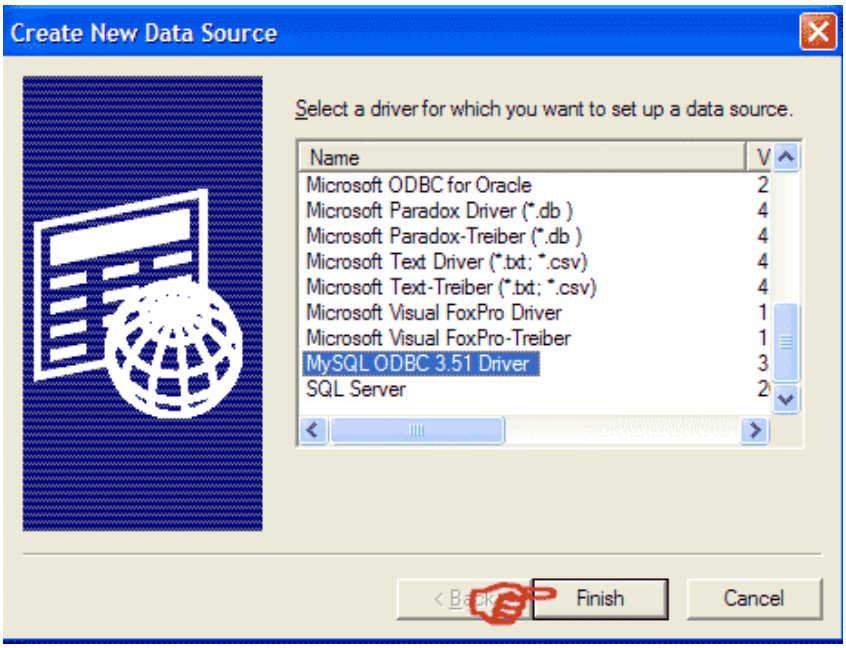


Fig. 4.10 MySQL APIs configuration in SMS Server – 2

After selection of MySQL ODBC driver the following screen will appear.

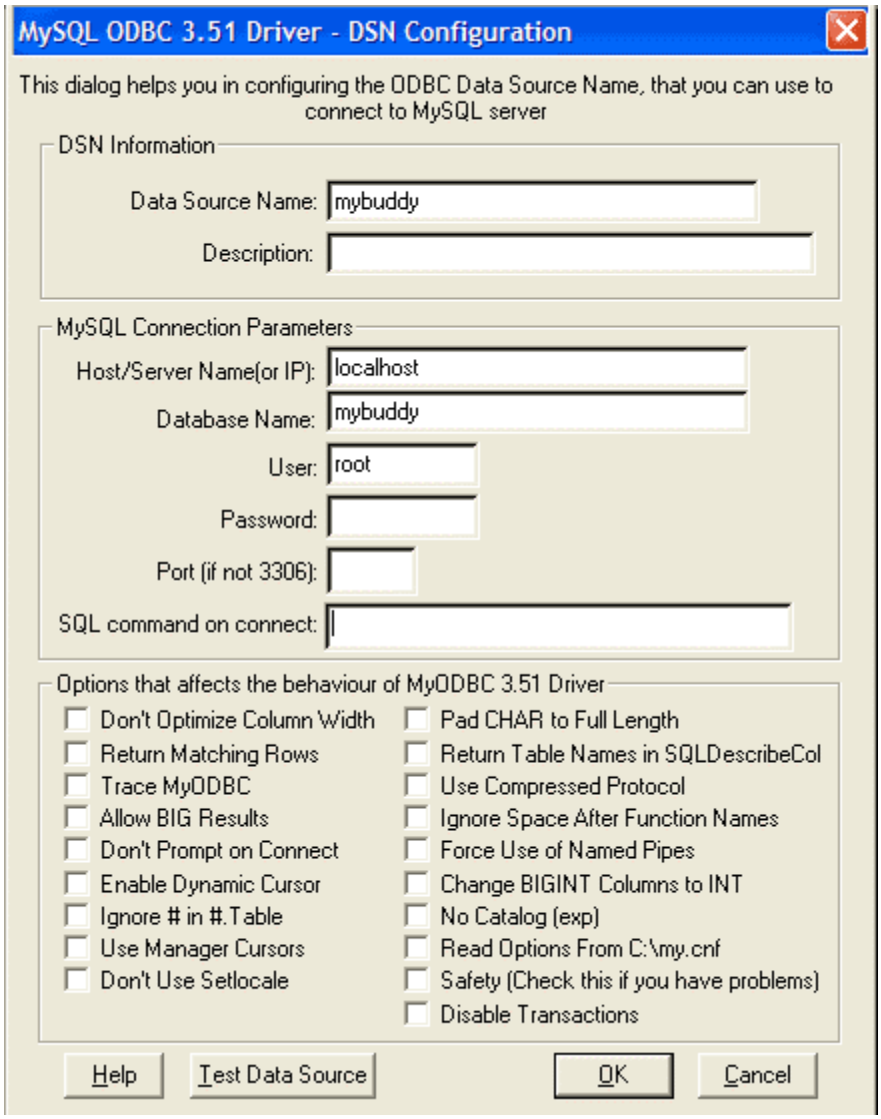


Fig. 4.11 MySQL APIs configuration in SMS Server – 3

In the MySQL ODBC driver configuration enter the details as seen in the figure (in the database name users will enter their database name) and after that users will fill in all the proper fields click on the Test Data Source to check if user will have properly configured Database settings. In case of successful connection the system prompt the database connected successfully. After successful connection the tools need MySQL API install to embed OZEKI SMS server with MySQL.

Plug-in Installations

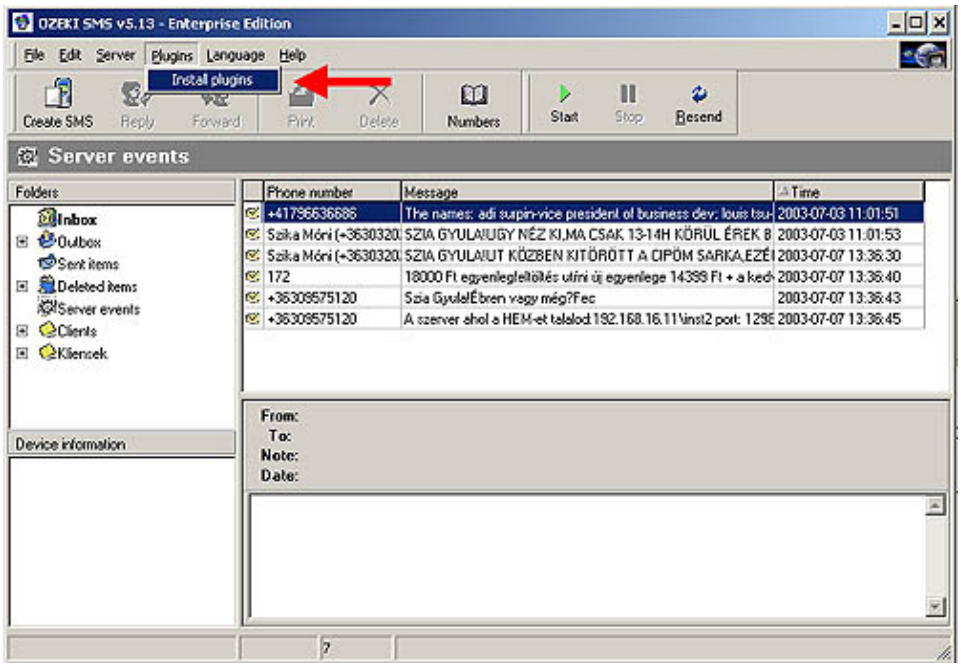


Fig. 4.12 MySQL Plug-in configuration in SMS server - 1

The next screen is appearing as follow.

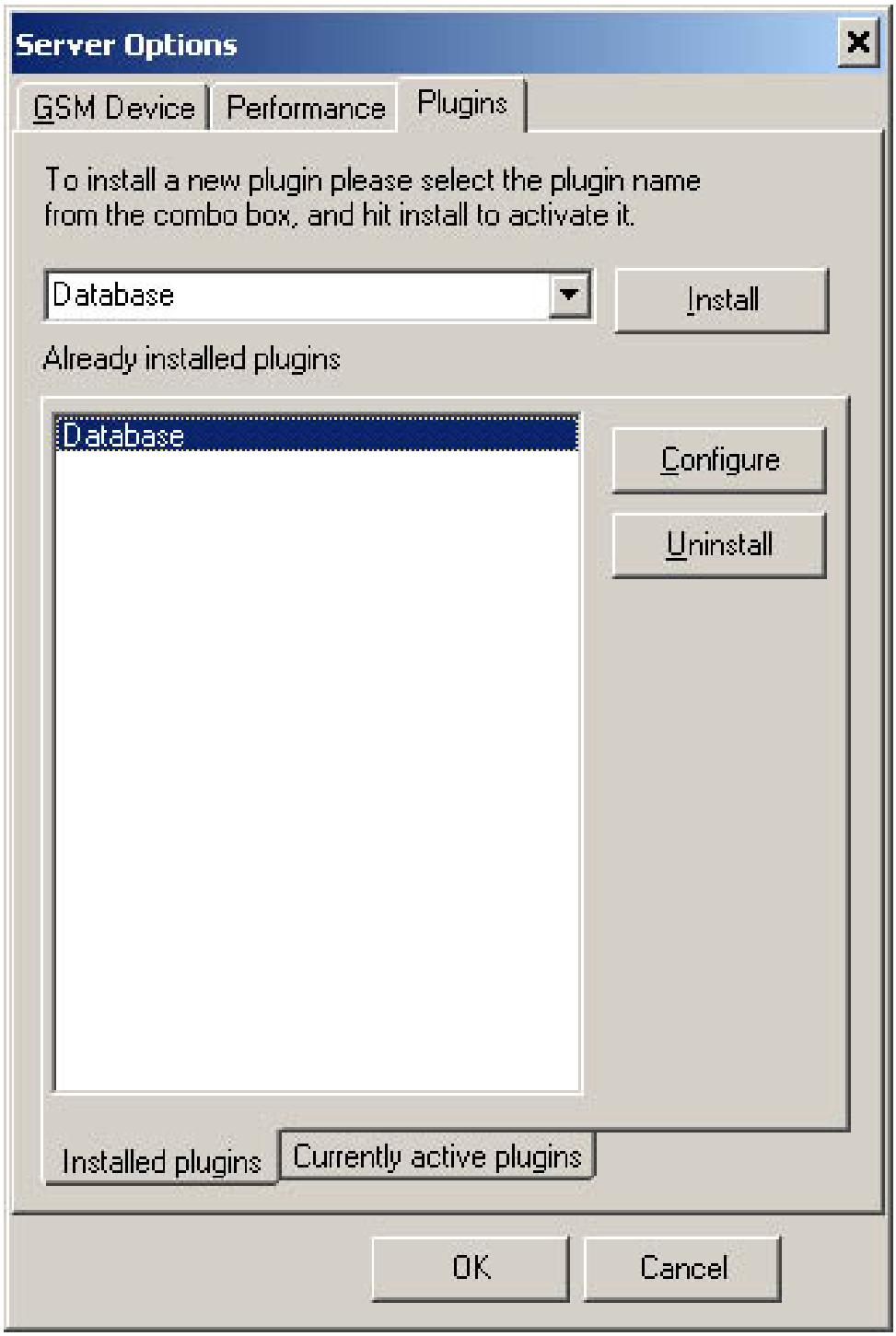


Fig. 4.13 MySQL Plug-in configuration in SMS server - 2

Select Database from the drop down and hit the Install button. After the plug-in is activated it is able for next step of configuration. Configure the database connection in OZEKI SMS, user can do this by clicking on the configure button at the plug-in activation form.

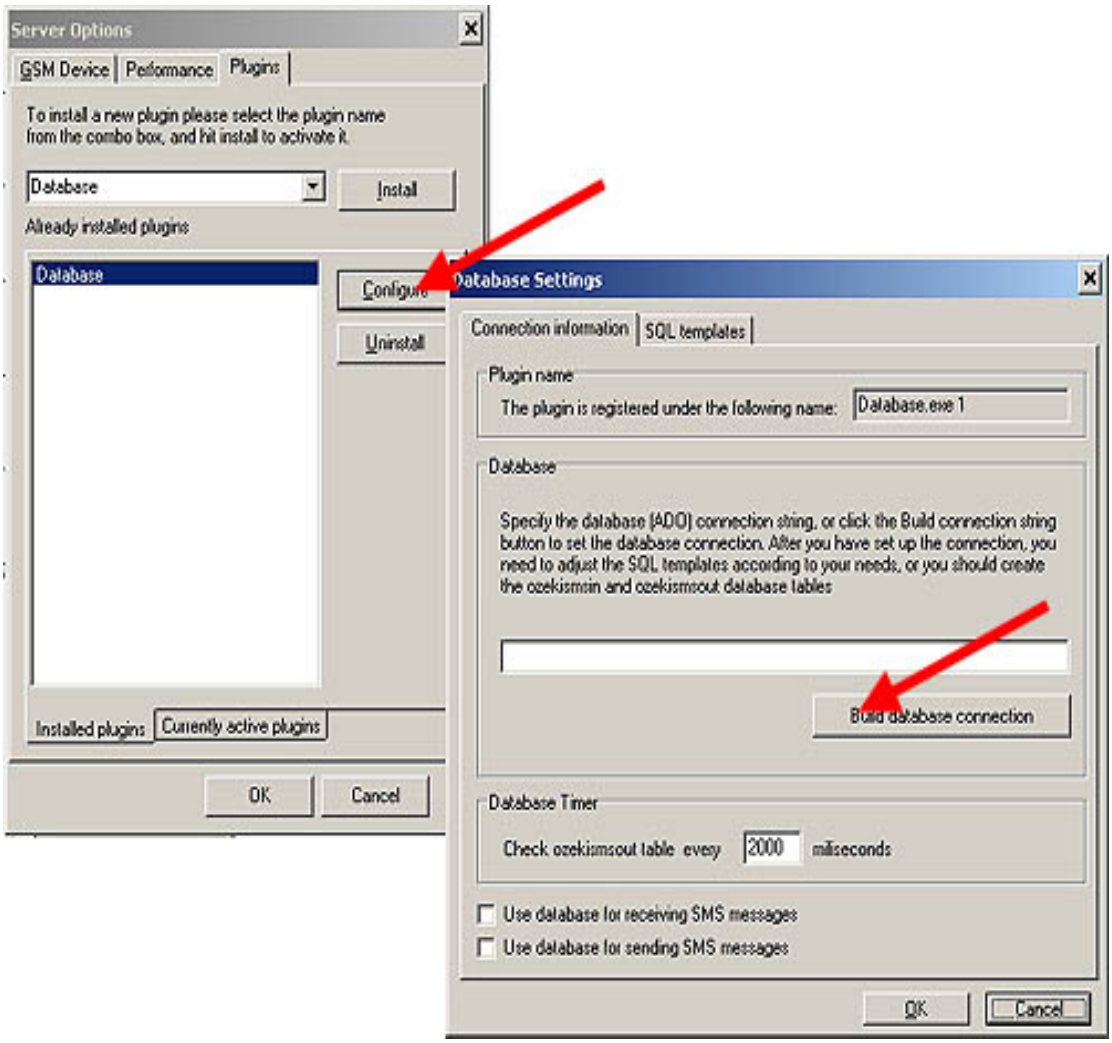


Fig. 4.14 MySQL Plug-in configuration in SMS server - 3

On the Database Settings form, clik on the Build database connection button. This will bring up the connection selection dialog.

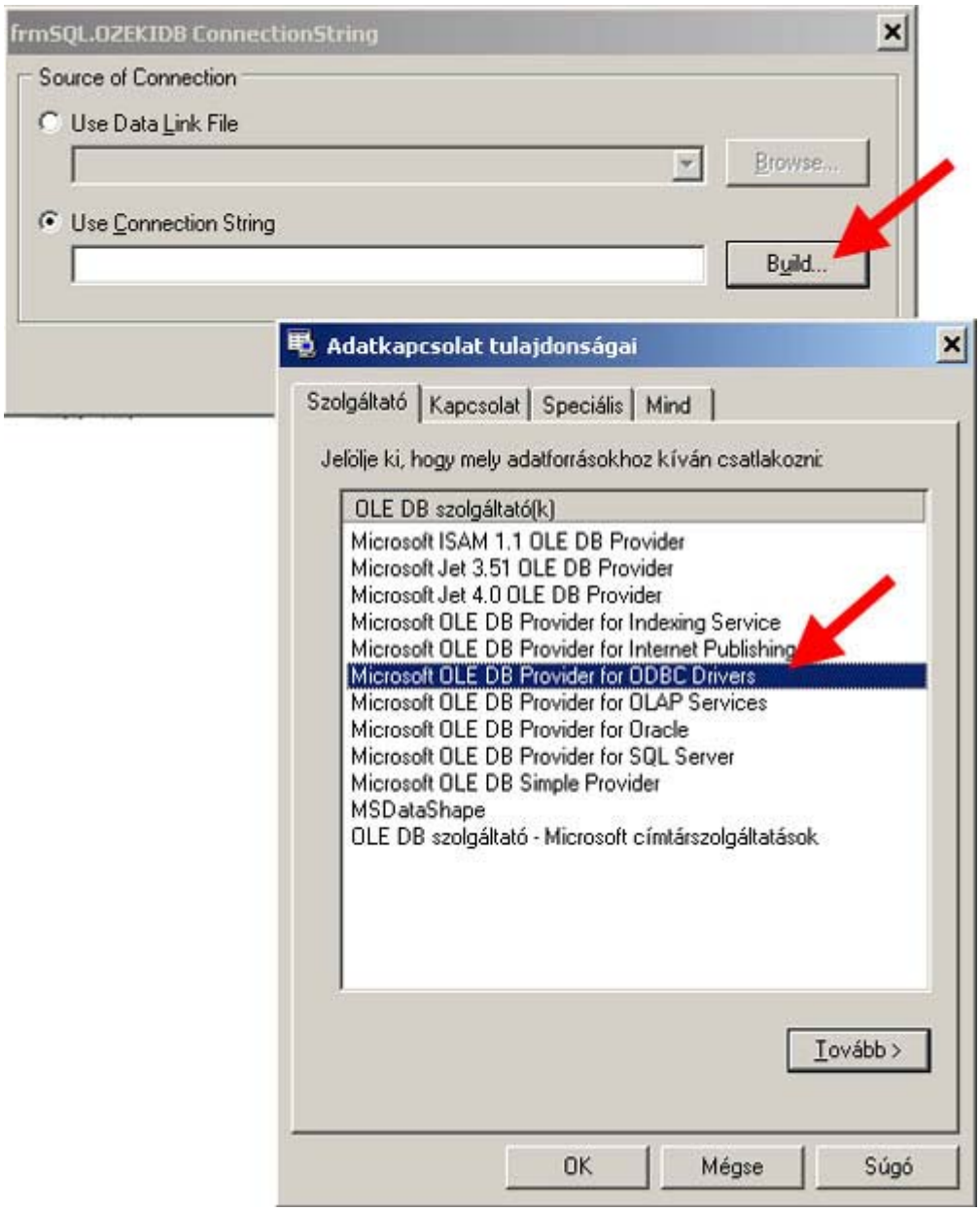


Fig. 4.15 MySQL Plug-in configuration in SMS server - 4

On the connection tab, user can specify the ODBC data source: in our case the model already is having configured mybuddy as a data source in the previous configuration step and user just need to supply the login name and the password in the next configuration step as shown in following figure.

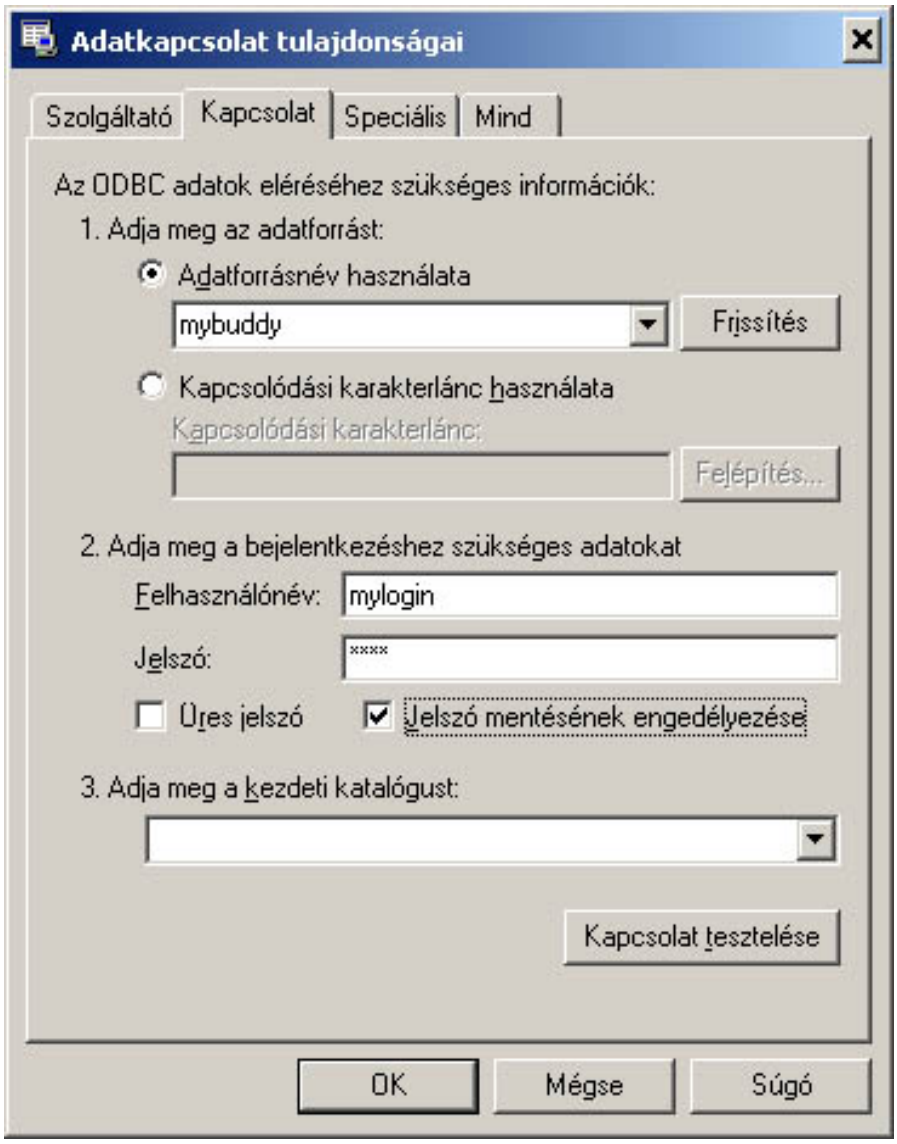


Fig. 4.16 MySQL Plug-in configuration in SMS server - 5

After this is done, System Administrator needs to make sure about test the connection by clicking on the Test Connection button located in the lower right hand corner of the form. Press OK to finalize the settings. When the appropriate scripts are created users are ready to send and receive SMS from customized applications. This benefit is get through the OZEKIsmsin and OZEKIsmsout tables. The great thing about this approach is that it is very convenient to use and it can survive network errors. If, for example, the network connection between the database server and the SMS server fails

for a period of time, all the incoming and outgoing messages are saved. When the connection resumes they are sent or inserted to the database. System Administraot can monitor ODBC events with the help of the event monitor window of the OZEKI SMS Server. Due to predefined APIs in form Query action the tool is sending the SMS when the record is inserted in the OZEKIsmsout table. As well it create the MySQL records when the OZEKI SMS server recice the message in attached GSM Modem or in GSM Mobile. The APIs are shown in following figure.

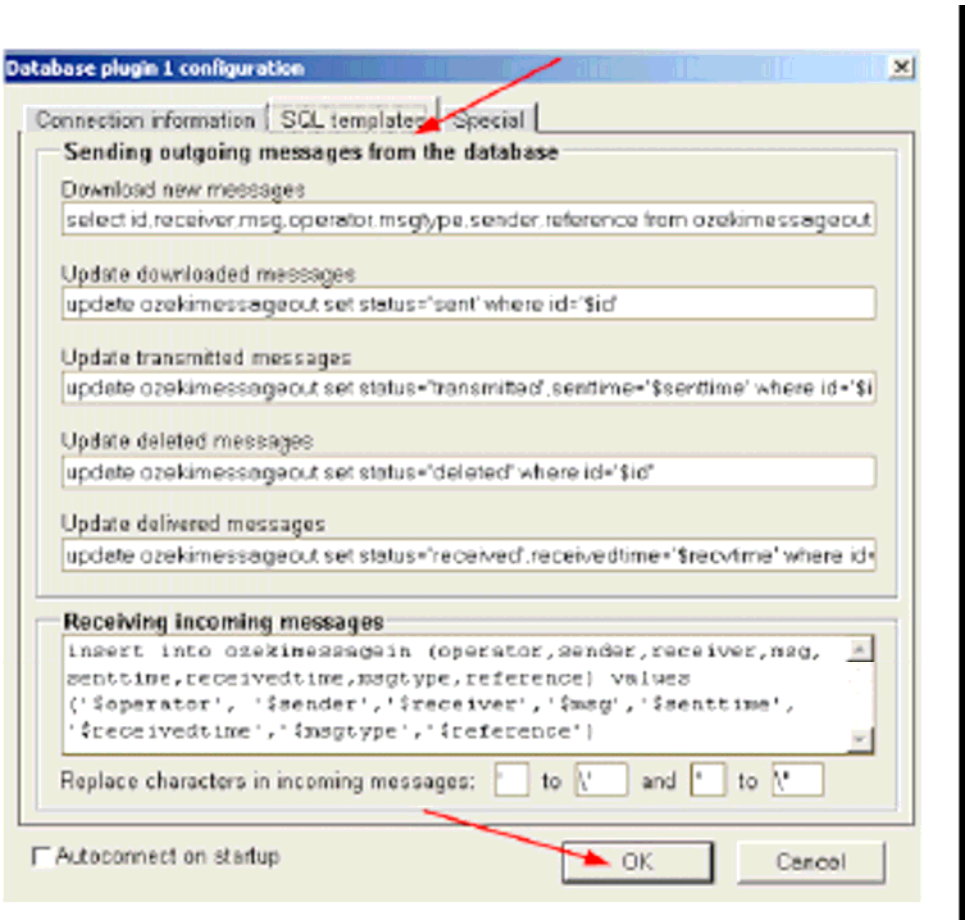


Fig. 4.17 MySQL Plug-in configuration in SMS server - 6

Message state updates

The OZEKImessageout table has a field called "status". This field contains information about the state of the outgoing message. When a new message needs to be sent, the status field should be set to "**send**". This value indicates that the SMS should be downloaded from the outgoing message table for delivery by OZEKI Message Server 6. After this download happens OZEKI will update the status to "**sent**", to make sure the next time this message is not downloaded again. If the message is in the "sent" state it means it is waiting in the outgoing message queue of OZEKI, but it is not yet sent to the provider. If the GSM service provider accepts the message it's state is updated to "**transmitted**". If the message is not accepted by the provider for delivery, for example due to an invalid telephone number, the state is changed to "**deleted**". In some situations the provider can send a delivery report back to the system if the message is successfully delivered to the destination phone. In this case the message state is changed to "**received**" from "**transmitted**".

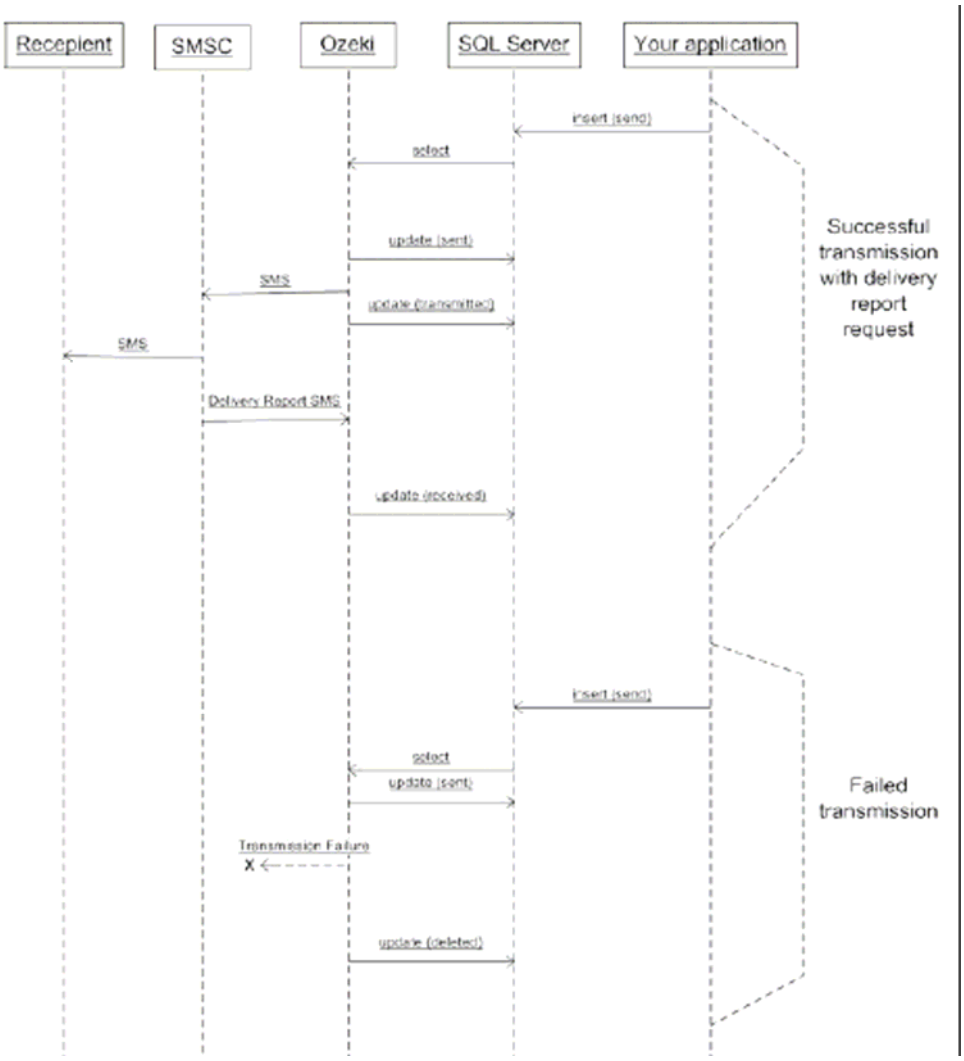


Fig. 4.18 Message Status Updation Process

SMS API for PHP developers

OZEKI Message Server can be used to send out SMS messages from any application. In order to send a message, the application must perform an HTTP request. The built in web server of the OZEKI Message Server receives the request and adds the posted SMS message to the outgoing message queue. After some time the message will be sent. (The status of the outgoing message can be queried by subsequent HTTP requests) To send an SMS message from PHP, System Administrator may use the following code. This

example will send a text message containing the text "ICICI BANK security is crossed your interested high rate? To send the stock send replay Y QTY" to the telephone number +919898458641.

```
<?php
$gatewayURL = 'http://localhost:9333/ozeki?';
$request = 'login=admin';
$request .= '&password=abc123';
$request .= '&action=sendMessage';
$request .= '&messageType=GSMSMS';
$request .= '&recepient='.urlencode('+919898458641);
$request .= '&messageData='.urlencode("ICICI BANK security is crossed your interested high rate? To send the stock send replay Y QTY ");
$url = $gatewayURL . $request;
//Open the URL to send the message
file($url);
?>
```

4.1.2.2 MMS WAP Push Implementation

In the MMS WAP Push Implementation the model is extending its services by facilitate Multimedia Alerts and WAP Push. The model implantation also use NOW SMS/MMS gateway tool for delivery of the alerts in form of MMS with URL push information to retrieve the user's decision. As like SMS server configuration here also the GSM Mobile is providing the connection facilities with Wireless Network.

The NOW SMS/MMS Gateway configuration with Research Model

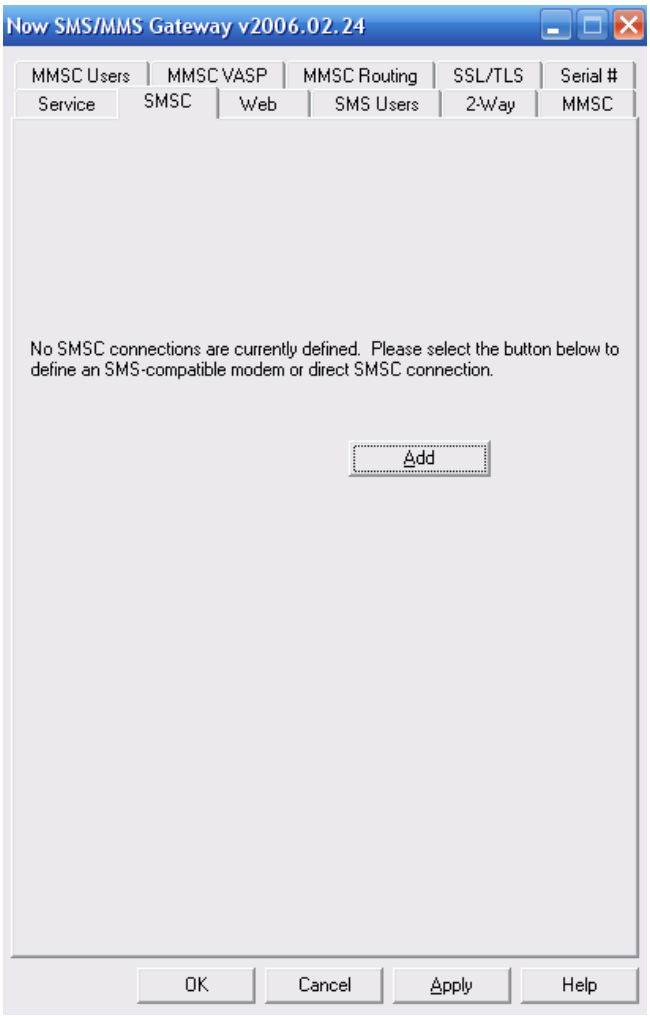


Fig. 4.19 Wireless Connective Node configuration in MMS server – 1

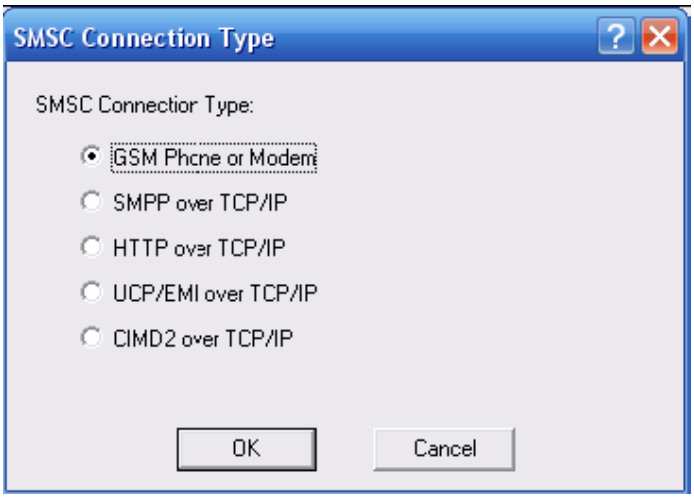


Fig. 4.20 Wireless Connective Node configuration in MMS server - 2

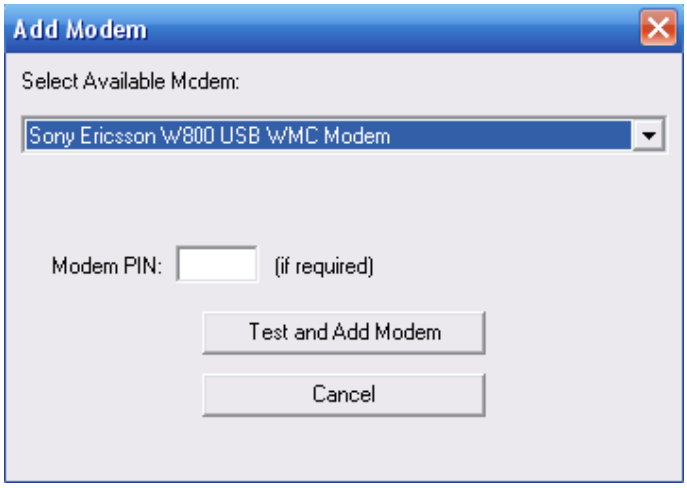


Fig. 4.21 Appropriate wireless node selection

In the research model we have used Nokia GSM mobile for connective node which is connected with Application server through cable. And it also needs the Modem PIN which is the SIM Pin Number in this case. After applying the appropriate connectivity value the tool return the successful connection Message as shown in following figure.

MMS messages are delivered using a combination of SMS and WAP technologies.

When a mobile phone receives an MMS message, what it is actually receiving is an MMS notification message which it receives over SMS (WAP Push). This MMS notification message contains header information about the MMS message, and a URL pointer that the recipient must fetch in order to retrieve the content of the MMS message. This URL pointer is a dynamically generated URL for the MMS message content which is stored on the MMSC. In a typical

phone-to-phone MMS transaction, the process of sending and receiving the MMS message works like this:

- The sending phone initiates a data connection that provides TCP/IP network connectivity, usually over GPRS.
- The sending phone performs an HTTP POST to an MMSC of the MMS message encoding in the MMS Encapsulation Format, as defined by the Open Mobile Alliance. The encoded MMS message includes all of the content of the MMS message, as well as header information, including a list of intended recipients for the message. (Note: In most environments, the HTTP POST will be routed through a proxy server. Some devices will use wireless profiled HTTP and TCP through a WAP 2.0 proxy server, while other devices will use the Wireless Session Protocol, WSP, through a conventional WAP proxy server/gateway.)
- The MMSC receives the MMS message submission and validates the message sender.
- The MMSC stores the content of the MMS message and makes it available as a dynamically generated URL link.
- The MMSC generates an MMS notification message, which is sent via WAP Push over SMS to the message recipient(s). This MMS notification message contains a URL pointer to the dynamically generated MMS content.
- The recipient receives the MMS notification message. It then initiates a data connection that provides TCP/IP network connectivity (usually over GPRS).
- The recipient phone performs an HTTP (or WSP) get to retrieve the MMS message content URL from the MMSC.

Configuring the MMSC for research Model

The "MMSC" configuration dialog specifies general configuration information for the MMSC:

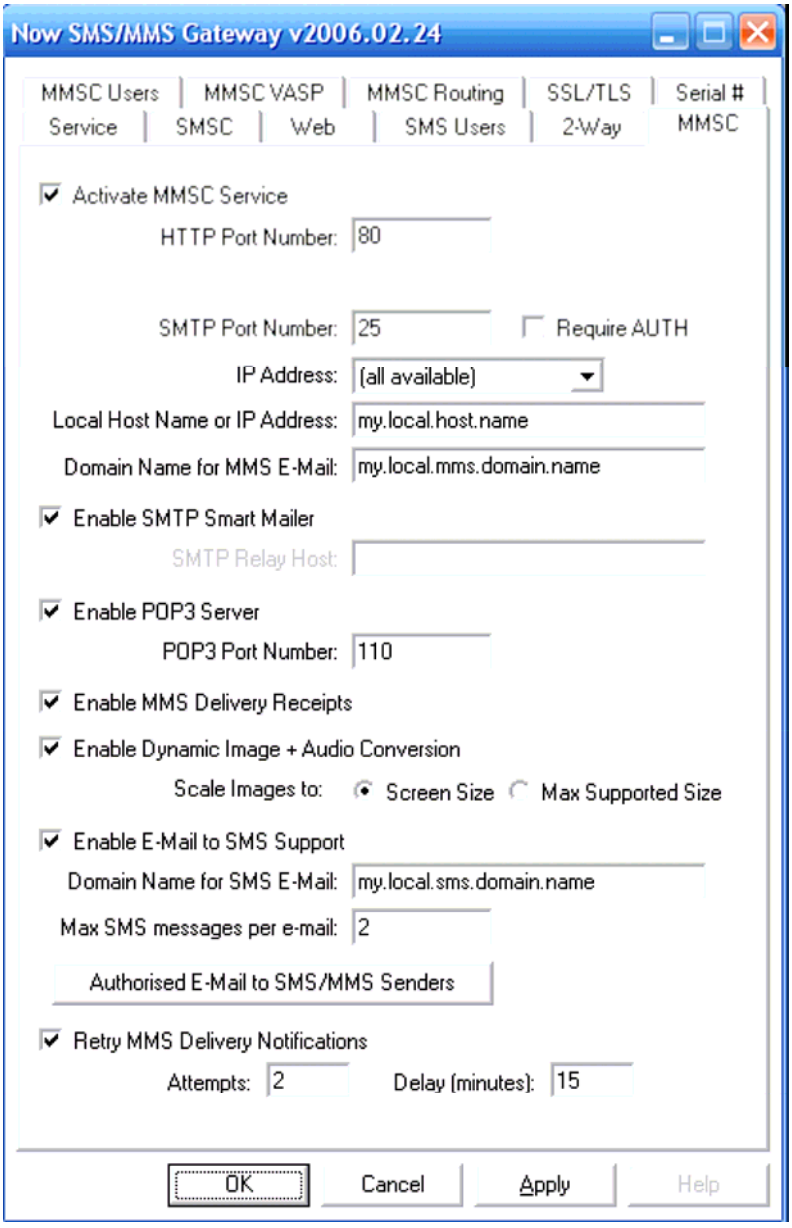


Fig. 4.22 MMS server configuration

The MMSC runs as a separate service process from the gateway. To activate the MMSC service, check the box next to the prompt "Activate MMSC Service". (The MMSC Service can also be activated on the "Service" page of the configuration.)

When a mobile phone sends or receives an MMS message, it makes an HTTP connection to an MMSC (usually through a WAP gateway). The MMSC contains an integrated HTTP server to process these connections. Please specify an available "HTTP Port Number" on the local computer for the HTTP server to accept connections from mobile phones. MMS messages can be sent to and received from, standard internet e-mail accounts. To support this functionality, the MMSC provides message format conversions between MMS and SMTP. To accept messages from internet e-mail accounts, the MMSC contains an integrated SMTP server. Please specify an available "SMTP Port Number" on the local computer for the SMTP server to accept e-mail messages from internet e-mail recipients.

The PC that is running the gateway might have other web and mail services installed. For this reason, the gateway allows to specify which of the available IP addresses on the current PC should be used by the gateway. The "IP Address" prompt displays the available IP addresses on the current PC. To make the gateway service available via any address on the current PC, select "(all available)", otherwise select a specific IP address. "Local Host Name or IP Address" specifies the local host name or IP address of the computer that is running the MMSC service. The name or address specified here will be used to construct URLs when sending MMS messages to mobile phones. If a host name is used, this host name must be defined in DNS and resolve back to the computer running the MMSC service.

"Domain Name for MMS E-Mail" specifies the SMTP domain name that is associated with users defined to the MMSC. When MMS users exchange e-mails messages with internet recipients, this is the SMTP domain name associated with the MMSC users. Note that the

MMSC acts as an e-mail server and it needs configure DNS for this domain name so that internet mail sent to this domain name is properly routed to the PC running the gateway.

When an MMS user sends a message to an SMTP recipient, the MMSC can either function as an "SMTP Smart Mailer" or it can route all outbound e-mail messages via an "SMTP Relay Host". If "Enable SMTP Smart Mailer" is checked, the MMSC will perform DNS lookups to locate remote recipients and perform SMTP e-mail delivery. If "Enable SMTP Smart Mailer" is not checked, it is required that an "SMTP Relay Host" be defined. When the smart mailer is not enabled, the MMSC will connect to the "SMTP Relay Host" to send all outbound SMTP e-mail messages. If System Administrator will be using an "SMTP Relay Host", He will have to define an appropriate SMTP mail server in network that will perform this SMTP message relay capability. Checking "Enable POP3 Server" enables the POP3 Server. The POP3 server allows user accounts defined in the "SMS Users" dialog to connect via the POP3 e-mail protocol in order to receive SMS or MMS messages (and connect via the SMTP e-mail protocol to send SMS or MMS messages). Checking "Enable MMS Delivery Receipts" should be checked if MMS delivery receipts should be supported by the MMSC. When an MMS message is sent with a delivery receipt requested, the MMSC generates a delivery receipt back to the sender when the message is delivered. In some installations, it may be desirable to disable delivery receipt capabilities.

Checking "Enable Dynamic Image and Audio Conversion" enables the dynamic content adaptation and conversion services of the MMSC. The MMSC uses WAP/MMS "User Agent Profile" capabilities to determine the MIME formats that a device supports, as well as the maximum size of images supported by the device. Where

required, the MMSC converts between common image formats (including, but not limited to GIF, JPG, PNG, BMP and WBMP) to deliver an image supported by the device. For images larger than the maximum size supported by the device, the MMSC will automatically scale the image to fit the device, speeding up download times. MIME types not supported by the receiving device, which cannot be supported, will be removed prior to delivery to the receiving device to prevent compatibility issues and unnecessary download delays.

The "Authorized E-Mail to SMS/MMS Senders" can define a list of users and/or domains that are allowed to send messages to SMS or MMS recipients via the MMSC can be configured as shown in following figure.

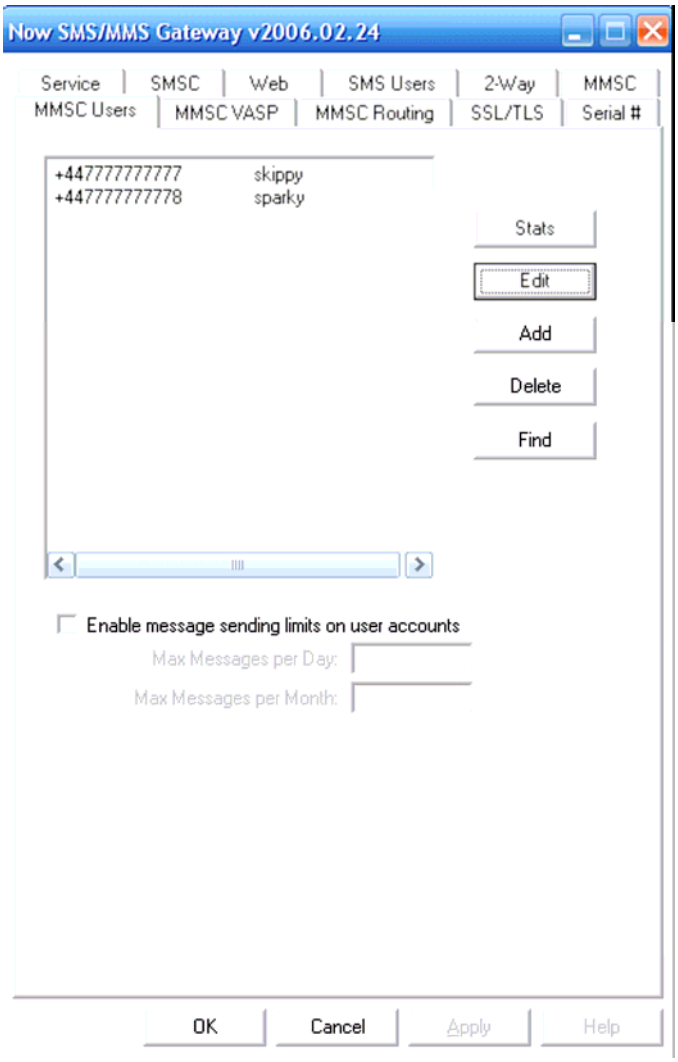


Fig. 4.23 User Profile management in MMS server

The MMSC built into the gateway supports the bi-directional exchange of MMS messages between mobile phone users and internet e-mail accounts. To enable this capability, the MMSC must be able to send and receive SMTP internet email. The configuration screens for the built-in MMSC, define the required settings for sending and receiving SMTP internet e-mail.

When a mobile phone user sends a message to an e-mail recipient, the gateway will convert the message to SMTP e-mail format.

Individual components of the MMS message will be sent as file attachments to the e-mail message.

To send an MMS message to a mobile phone from an e-mail client, address the message to username@mmsdomainname, where "username" is the alias name defined for the user on the "MMSC Users" dialog, and "mmsdomainname" is the "Domain Name for MMS E-Mail" defined on the "MMSC" dialog. E-mail attachments that are supported MMS content types (included in the MMSCTYPE.INI file) will be packaged and included in the MMS message sent to the mobile phone. By default, the e-mail to MMS gateway will only accept inbound e-mail messages addressed to one of the users defined to the MMSC. It is also possible to use the SMTP interface for the bulk sending of MMS (and SMS) messages by logging into the SMTP server using an email client that supports SMTP Authentication. When logged in via SMTP authentication, it is possible to send an MMS (or SMS) message to any recipient, by sending to addressing the message to "phonenumber@mms.domain.name", where "mms.domain.name" is the "Domain Name for MMS E-Mail" defined on the MMSC configuration dialog. An authenticated SMTP user can send an SMS message by addressing the message to "phonenumber@sms.domain.name", where "sms.domain.name" is the "Domain Name for SMS E-Mail" defined on the MMS configuration dialog. To define a user account that is allowed to login with SMTP Authentication, refer to the "SMS Users" configuration.

In research model sms.domain.name is localhost as well as mms.domain.name is also localhost.

The research model has created the MMSC users for individual 50 business profiles, which were created for testing of the results. The business profile having the mobile number and e-mail address in its web based model, which is used to create the accounts in the MMSC. On the periodic invocations of the mining full alerts generates which is send through SMS in previous model while this model is creating the trends graph of the security using genmms.php file and then the mail sending script with attachment send mail to the user on their e-mail account using account information of the user from web model where user stores their personal information and business profile.

As the mail receive at user's mail account the MMSC automatically parse the mail and convert in to MMS and send it to the use's mobile device with WAP push information as above specifications.

The user may able to take decision after seeing the MMS trend graph and alerts. The WAP push information facility user to rich on the WAP page of the transaction process as per the MMS trends received from the system.

4.2 Model Test Result

After successful implementations of the every model the 50 business profiles are created to test the model. In the testing process the model has taken rounded 100 securities listed in classified categories.

4.2.1 Pull Model Response

In the test process of WAP Pull model different users has very first register through www.mobile4u.co.in for registering with the m-commerce model and created their business profiles individual. The all user having different interested area for trading. This profile is not a constant entity in this model it means that the users has made changes in their categories list and company list as the business trends gone change day by day during testing of m-commerce model.

This model is tested through wireless devices. The purpose is to check the device independent capability of model results. The following vendor specific devices are used in testing of the process. In the testing process of WAP model in case of unavailability of physical device the test is performed through vendor specified emulators or Software Development Kit.

- Nokia Communicator 9290
- Nokia N-Gauge
- Nokia N90
- Palm Tungsten E2
- Palm Treo 650 (CDMA and GSM)
- Palm Tungsten T5
- Sony PSP
- Samsung D800
- Siemens SK65
- Samsung i300
- Nokia 7360
- Panasonic VS6
- i-Mate JAMin Phone / PDA
- Sony Ericsson Z520i
- Motorola L6
- Nokia N70 GSM / 3G Mobile Phone

- Sony Ericsson W900i
- Motorola V3
- i-mate K-JAM Phone PDA
- Motorola RAZR V3
- LG C1300
- LG F1900

During the testing process of the model the research found the little difference in terms of layouts, which over come with by modifying the scripts where it needed. As a result the model is capable to serve the device independent response delivery.

The user which takes part in testing process of WAP pull m-commerce has encountered simultaneous request through individual devices to take check the response capabilities of the WAP portal and get their desired Reponses which prove the feasible execution at application server. In every request execution research data measure the process time for result process. The current security price discover in the research m-commerce model is only step process a search security code and get result if the user is knowing the security code it facilities one step process prices discovery by entering exact security code. As the data extraction is already performed through cron-job process the WAP model generate fast result set using extracted data. The research also collected execution time data. Among the collected data research comes on the conclusion that most of the result is executed in 1 min. and the maximum time it took for execution is 5 min.

Process time of result delivery	Result	Percentages ratios
1 Minute	YES	87%
2 Minutes	YES	6%
3 Minutes	YES	3%

4 Minutes	YES	2%
5 Minutes	YES	1%
-	No	1%

In 87% test cases the system serves quick response to the wireless users by delivering successful results. While 12% cases the user benefited by getting the results but the response time is high. While in 1% cases the wireless device get error messages in retrieving the response form m-commerce WAP model.

The research study this error and list out the problems, which are responsible for this error and listed the following cases of errors.

- Application Load.
- Wireless Network Load.
- Low Processing Power devices.
- Connection breaks with wireless networks.

But over all result shows the exact result sent in most of cases. The error issues are network-triggered actions or due to devices incompatibility, which may overcome by selecting proper devices and by upgrading appropriate barrier services to deal with network, triggered actions.

4.2.2 Push Model Response

After checking the Pull results the business model stared the second face of the model, these push models are tested for the same 50 business profiles which are used test the m-commerce WAP pull model.

4.2.2.1 SMS Response

The 50 business profile created for the test of m-commerce having different companies selected in it as per the user interest. The individual user has set their interested sale price for the stock with interested high rate in the business profile in the case of user having that stocks availability of securities in their account. Also, the user set the interested low rates of the securities for which user are planning to purchase. The average sale calculated from business profiles is around 40 including both types of interest buy and sale. It meant that the model is expected to generate maximum 2000 business alerts per day in the stock hours. The figured of alerts quantity is purely different entity and it's purely depends upon the market trends.

As the price cross the high interest rate of any business users for specific securities the system the system encounter MySQL query which insert the record in MySQL table ozekismsout with following values.

- id = auto incremented value
- Sender = Mobile number of the GSM phone which is providing the role of GSM connectivity in the model which also help user to send the response.
- receiver = user's mobile for whom the alert is genrated
- msg = Sale alerts text with current price value.
- senttime = time value when the message arrive in the MySQL table
- receivedtime = time value when user received the alerts
- status = when record is created the system store "send" as a value of this filed but it was updated when the SMS action is performed like (sent and received)

- operator = user's operator name to route the SMS in specific SMSC.

After arrival of the MySQL record in ozekismsout the OZEKI SMS server APIs perform its role and the message is delivered to user. In every case the alert generation, MySQL record creation and the OZEKI SMS server sending process took maximum of 15 seconds time when the alerts parallel executions are in large quantity. While some time all the processes is completed in 2-5 seconds. The test results are found that the average execution time is 3 seconds for all the delivery. When the transmission is performed from model application server its all up to the wireless networks and SMSC center load of the user. The test results of the SMS push model is gives the conclusion that in maximum test results the business alerts is rich at the user's mobile device in 5 to 10 seconds. This proves the feasibility value of the business alerts in SMS push m-commerce model.

Few of the alerts are received late at the user end and due to network trigger actions or overload at user's SMSC server. But, this is a crucial situation for the user when due to SMSC server load the important business alerts is rich late to the user end. So it is necessary for system to send the time stamp value of the alerts in the message body. It is necessary because some time user may get the late response due network trigger event and when it rich at the users end the alert is may be incorrect as per the received time gap. User must know the actual gap while their mobile station retrieves the business alerts. It is only possible if user received the alerts time value in SMS. It will help user to take decision of the alerts.

The user may respond the business alert in the form of business transactions by sending the response SMS to the same mobile station number from where user get the business alerts.

The response methods having predefined message formats so that system which is responsible for receiving SMS of the user's response may interpret the proper business transactions. The format of buy response is "B SECURITYCODE TRADEQUANTITY" and the format of sale "S SECURITYCODE TRADEQUANTITY". In the testing propose model received both types of response from the user in the form of SMS. The SMS very first rich at the OZEKI SMS server and the OZEKI SMS server APIs create the MySQL records for every received SMS in ozekismsin MySQL table. The values of the received message at MySQL table are listed below.

- id = auto incremented value
- sender = user mobile number
- receiver = Mobile number of the GSM phone which is providing the role of GSM connectivity in the model which also help user to send the response.
- msg = alerts response (as per the predefined format of response)
- senttime = message sent time when user sent it from their mobile device
- receivedtime = SMS arrival time at OZEKI SMS server
- operator = User's mobile operator name.

For every test response SMS the application server parse the msg values through PHP script and analyze the appropriate business transactions from SMS body. The transaction is logs at the transactions table and flushes at back office, which performs the user's actual business transactions for stock sale and stock purchase. Due to unavailability of Back office supports the model is

designed up to business transactions log generations only. This is to be extended by embedding the back office with current m-commerce SMS push model.

4.2.2.2 MMS WAP Push Response

this model is serving user in through tow services the MMS and WAP Push. The MMS is the type of messaging content but it involves multimedia data for effective presentations of content.

The existing 50 business profiles are which was getting benefits of business alerts of the text SMS alerts the algorithm is used to produce the content. But to receive the MMS information the user profile need to configure at MMSC which is configured though Now SMS / MMS tools in our developed m-commerce MMS WAP Push model. the MMSC configuration is needed the mobile number of the user the unique user ID for all the business profiles and e-mail address for the MMS delivery. The model also needs the mail server configured at the application server the MMSC resides. We have Java mail server at the application server to full fill the MMS delivery requirements of developed model. After the configuration of java mail server the 50 mail account is added in the mail server and then it was configured with MMSC with respective user account details.

The business model also used the past rates during the alert creation and through GD library and PHP application server created the graphs, which is delivered to the user as a multimedia content. The MMS data is delivered at user's mail account. The research model configured the MMSC with the mail server, which available at same application server so that it extract the mails from mail server, automatically. And after the checking the MMSC user's profile it transmit the multimedia content of the mail to user's mobile devices.

The process in MMS delivery is little late response in comparison SMS delivery. As the content generation is need to be process after receiving the alerts from application. And the delivery path is also through application to mail server and from mail server to MMSc. In comparison of Push Content delivery research discover the fact is the MMS content is deliver little slow in comparison of SMS content. But the interactive content availability by involving multimedia component in the content user gets benefited by taking fast decision.

With this MMS alerts user also send the action URL of the alerts, which is either buy transaction, or sell transaction. This URL is send with MMS as a WAP push user may get the screen or alerting through content and the WAP push transmits the user navigation to the transaction page where user can processed for the transaction. As earlier mention due to unavailability of back office support this model is also designed up to create the business logs.

The model also discover the lose of alerts in this model in few of the cases due to network trigger event as like the previous SMS push model. But the ratio of lose is little high in comparison of SMS model. It's due to process queue in mail server which is participant elements of MMS delivery also affect in this model.

4.3 Pull and Push Comparison

One major problem is noticed in the testing of WAP Pull m-commerce model is though user is get benefited by getting current price details in most of case user has not initiated the business transaction. Because when user is extracting the current price

through model it is not possible that the current price comes in user's interested criteria. So, user needs to check the current price ever and ever until it match the interested criteria. After implementation of the PUSH model the application server it self watch the user profile and in the case of match the system itself transmit the business alerts to the user which user interaction time with the system. And also reduce the network by removing the users request process (pull process).

Chapter – 5

5.1. Summary of work

This research has thoroughly studied enterprise applications. In this study there are some applications, which involved response data, and decision making on analysis of this data. The present mobile device which looks meeting for communication only, can extensively be useful for exchange of response and decision making data. For example, CDMA Technologies and GPRS barrier service facilities this exchange. If the push technology be seamless be integrated with wireless computing than it is possible to send vital utility response device to pervasive devices of the user. The research also involve the various wireless technology generations study for analyze the need of application implementations.

The research then moved toward the actual model development of the m-commerce which facilitates the business services on anytime anywhere environment though user's pervasive devices in its next face. The research also analyzes the features availability with different vendor's pervasive devices like Mobiles, Palms and PDAs for generation of device independent information and its delivery. For selection of m-commerce research model generation the research took survey of various business industries and its existing applications. The research took decision of model generation for stock industries after analyzing its business need of high volume data interchange, fast alerts, and fast response anytime anywhere.

The mobile trading model of the current research in which the integration of push technology with wireless computing has been proposed and prototype implementation has been architected. The prototype collects the data from portal NSE through parsing and

text mining techniques. This generated data is used to process in the WAP Push model for result discovery. The collected data is also processed in decision algorithms and generates push responses. These responses are then delivered to user's pervasive devices through deployed technologies and beerier services. User on getting these responses needs to take some actions and these actions are translated in transaction to complete the intended process.

In the domain of enterprise application on web environment, user needs a continuous observation for the purpose. The research model facilities the pervasive device to take a role of making the information to reach to user instantly and users action in this regards is translated in to transaction to complete the process making user free for other important works. These proposed model base system enhancing fast decision making and facilitating business transaction comparatively in large domain.

5.2. Conclusion

The research started with aim of study, model generation, implementation issues and analysis for mobile commerce. The study of the various wireless technologies and barrier services shown that the new wireless generation technology is able to provide the environment to the mobile commerce applications. The study for the research also evaluated the features availability in various wireless technologies which help towards appropriate model designing in different environment. Mobile commerce model generation process of research takes care for the entire user community having different technologies and service availability on their pervasive devices by developing three different application models. Through these models user get benefited two types of services. One is pull services WAP model which is accessible through

2.5G onwards wireless technology by requesting application server for the services. The other two types model is serving it's services without user's request though SMS push and WAP Push. The SMS push services is also accessible in old wireless technologies which have the SMS barrier service feature. And WAP Push is for advance wireless technologies to take significant advance of technological benefits by getting interactive alerts. It concludes that research models are developed in manner to serve their services in different wireless technologies with its suitable architecture. The mobile commerce is extension of existing enterprise application running in the WWW backbone. Implementation issues need to be taken while migrating from e-commerce to mobile commerce application. One of the most important issues of development cost for mobile commerce application is overcome by selecting the open source environment in model development. During the implementation of mobile commerce applications the one more issue is to taken care of running existing application which my overcome by inheriting the existing e-commerce application on m-commerce application development. After analyzing the outcomes and results from all the developed mobile commerce model research found that the business services are extended through this valuable addition of pervasive device access. The analysis shows that the user who has the new generation pervasive devices may not need to move at their desktop computing node. And the anytime and anywhere services is the added bunch of mobile commerce application.

5.3. Future extensions

The model having its capability of serving business information and make possible the business transaction through the pervasive device is fulfilling the demand of the user. But, certain aspects of the development process of the model need to replace through

enhanced techniques. To get fast results and achieve accuracy of business process. The developed m-commerce is using the parsing and text mining techniques for retrieval for business data from stock exchange which may replace with XML and web services.
Now a day all the enterprise web applications are producing the XML feedback for sharing information on internet backbone. The enterprise applications are using the generalize standards for XML document creations. XML document is created with specified Document Type Definition (DTD) which helps other application to interpret the Data.

The methods which are used in the model is text mining and parsing which is a set of rules for extract the data from the unstructured documents. This process took time in execution which consuming the processing power of application power as well responsible for delay in data availability which may overcome in XML data extractions. The XML is a need for data interchange medium. The NSE portal is the ground level source of this model which facility the data. The implementation of XML data extractions is possible when the NSE make Avila be this feature with their portal.

The current model is designed and developed which facilitate users to receive the alerts initiates the action for the alerts. While, user is performing the action the application server is able to create the appropriate business transaction logs of user's response. The research mention that the business transaction is not actually applying at the Back office due to unavailability of standards through which model application and back office can interchange the data. The evolution of such standards makes possible the user's business logs with actual transition at back office. The future work in this area need to be developed. The authentication and other security need to be taken care while developing such standers.

The current payment getaway service providers are only facilitating their high volume payment services at web based environment in e-commerce application. While for pervasive device application payment gateway service providers are facilitating the micro payment options for low volume payments. This service mode needs to be extended as the existing web based applications are moving towards the wireless backbone for pervasive devices.

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